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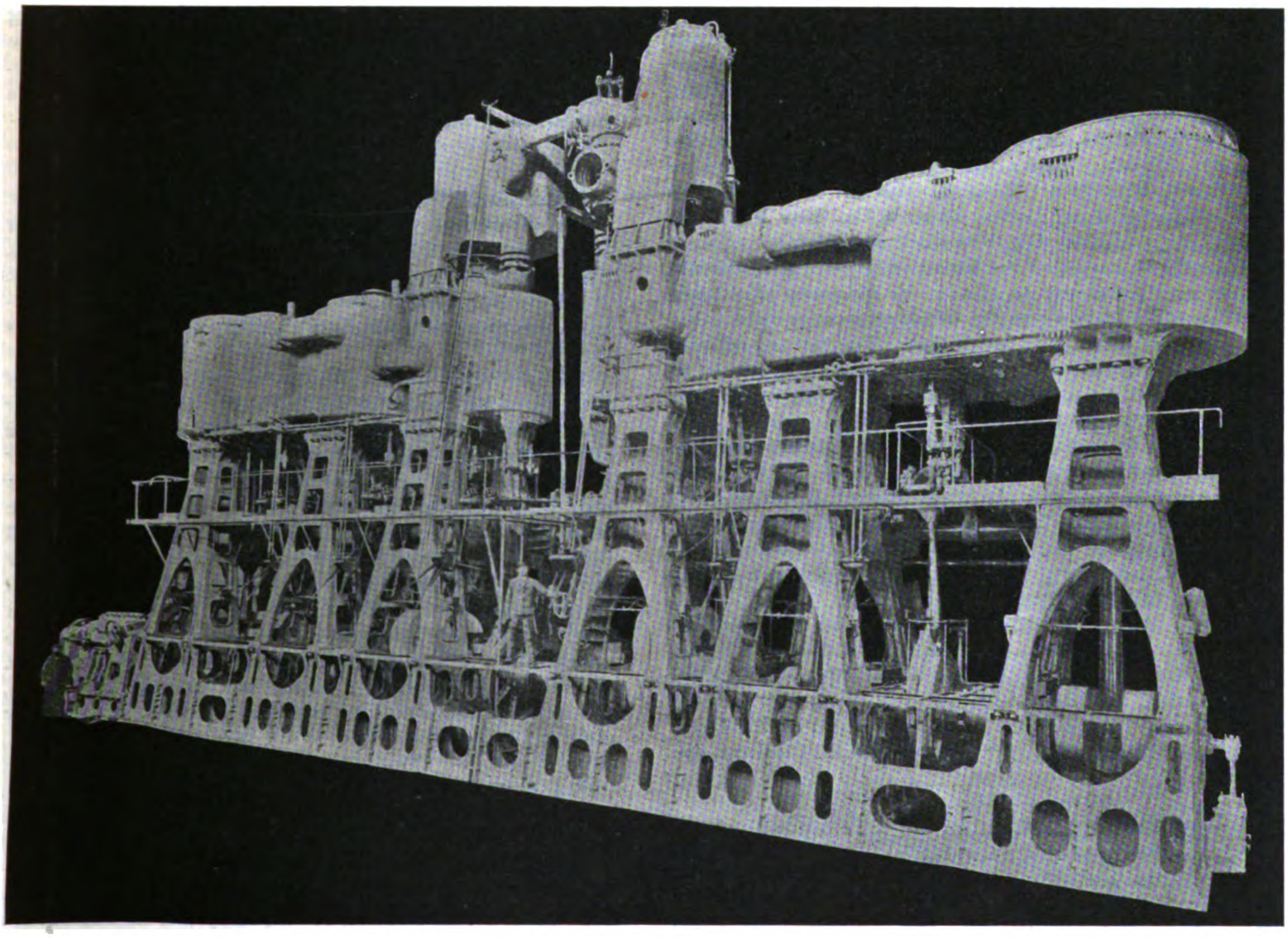
PANAMA CANAL COMMISSION OPENS BIDS.

Washington, Dec. 5.—The Panama Canal Commission has within the past few days opened bids for a considerable quantity of machine tools and similar equipment. In the class calling for two band saws two automatic saw-setting machines and one saw table only two bidders submitted proposals for the entire enumeration. The Handlan, Buck Manufacturing Co. of St. Louis placed a bid of $1,410 and Manning Maxwell & Moore of New York city, offered a bid of $942.10. In the class comprising three engine lathes and



A PAIR OF QUADRUPLE EXPANSION ENGINES OF THE KAISER WILHELM II. CONSTRUCTED FOR THE NORTH GERMAN LLOYD STEAMSHIP CO. BY THE STETTINER AKTEENGESELLSCHAFT VULCAN.

one pattern makers' lathe the bids submitted were as follows: C. T. Patterson Co., of New Orleans, La., $2,710; Prentiss Tool & Supply Co., of New York city, $2,382; Halliday Machinery Co., Seattle, Wash., $2,684.75; Manning, Maxwell & Moore, New York city, $2,950.75; Mortley, Green & Co., New York city, $2,225; Garvin Machine Co, New York city, $2,601 or $2,761; Niles, Bement Pond Co., New York city, $2,767.

For one upright drill the bidders and their proposals were: C. T. Patterson Co., New Orleans, La., $305; Prentiss Tool & Supply Co., New York city $269; Handlan, Buck Mfg. Co., St. Louis, Mo., $300; Manning, Maxwell & Moore, New York city, $259.60; Motley, Green & Co., New York city, $332.50; Garvin Machine Co., New York city, $261; Niles Bement Pond Co., $235; Royce & Ricketts, Washington, D. C. $233.

For two sets of plate bending rolls proposals were submitted as follows: Prentiss Tool & Supply Co., New York city, $1,820; Halliday Machinery Co., Seattle, Wash., $2,700; Handlan-Buck Mfg. Co., St. Louis, Mo., $3,700; Manning, Maxwell & Moore, New York city, $3,118; Motley, Green & Co., New York city, $4,210; Cleveland Punch & Shear Works, Cleveland, Ohio, $2,930 and $4,734; Niles-Bement-Pond Co., New York city, $4,360; Royce & Ricketts, Washington, D. C., $3,580, $4,780 and $3,860.

The bidders for two power double punch and shears with their respective proposals were as follows: Prentiss Tool & Supply Co., New York city, $1,800; Halliday Machinery Co., Seattle, Wash., $1,860; Handlan-Buck Mfg. Co., St. Louis, Mo., $1,600; Manning, Maxwell & Moore, New York city, $2,238; Cleveland Punch & Shear Works, Cleveland, $2,526; Niles-Bement-Pond Co., New York city, $1,932; Royce & Ricketts, Washington, D. C., $1,700.

The call for one 24-in. planer brought forth proposals as follows: C. T. Patterson Co., New Orleans, La., $595; New Haven Mfg. Co., New Haven, Conn., $608; Prentiss Tool & Supply Co., New York city, $545; Halliday Machinery Co., Seattle, Wash., $543; Handlan-Buck Mfg. Co., St. Louis, Mo., $600; Manning, Maxwell & Moore Co., New York city, $524; Motley, Green & Co., New York city, $565; Garvin Machine Co., New York city, $635.

Bids will be opened at the bureau of supplies and accounts of the navy department on Dec. 12 for furnishing steel tubes and hoops for delivery at the Washington navy yard. One tube and six hoops is to weigh 84,942 lb.; the second tube on the list together with five hoops is to have a weight of 59,228 lb. and the third tube with three hoops is to have an aggregate weight of 75,070 lb.

The navy department recently received bids for one 125-ton bar straightening press as follows: R. W. Geldart, New York city, $504.80; Drew Machinery Agency, Manchester, N. H., $637; Manning, Maxwell & Moore, New York city, $598.50; Manhattan Supply Co., New York city, $620; H. A. Rogers Co., New York city, $585; Sherman Brown Clements Co., New York city, $594.94.

On one 3½-in. hydraulic shaft straightener the proposals offered were as follows: R. W. Geldart, New York city, $224.45; Drew Machinery Agency, Manchester, N. H., $229.50; Manning, Maxwell & Moore, New York city, $212.62; Manhattan Supply Co., New York city, $222.40; H. A. Rogers Co., New York city, $206.50; Sherman Brown Clements Co., $211.93.

SERIOUS COLLISION OF STEAMERS.

On the morning of Nov. 13, a collision occurred between the United States lighthouse tender Madrono, and the gasoline schooner Nonpariel, at San Francisco, Cal. As a result of the collision a sailor—John Boer—was knocked overboard from the Nonpariel, and drowned, and Capt. Murphy of the Nonpariel seriously injured. The collision occurred in broad daylight, and in clear weather. Evidently the responsibility of the accident rests with Capt. Mark Anderson, master of the Madrono. At least he made that admission to Capt. Murphy after the collision. Both vessels were damaged though the Nonpariel was the more serious. The latter vessel was just backing from her berth when the Madrono came along under full steam passing very close to the docks—closer it is claimed than the law allows. The matter will be investigated by the Board of Inspectors, and litigation will probably follow. Each vessel sounded whistles after the extreme danger was discovered, though then a collision was unavoidable.

JAPAN'S BUSY PORTS.

Editor Marine Review:—The eight months ended August 1905, were war months, yet the native and foreign shipping entering and clearing at Japanese ports, showed large increases over the corresponding months of 1904, also war months, except the first, January. Note the figures in tons:

Entered	1905	1904	Increase
Japanese	1,047,883	837,452	210,431
Foreign	8,335,491	6,890,655	1,444,836
Totals	9,383,374	7,728,107	1,655,267
Cleared			
Japanese	1,045,779	722,324	323,455
Foreign	8,154,426,	6,752,813	1,401,613
Total	9,200,205	7,475,137	1,725,068

Summary, 1905:

	1905	1904	Increase
Entered			
Cleared	9,200,205	Increase	1,725,068
Total business	18,583,579		3,380,335

Compared with 1904, eight months, the increase is over 20 percent. Considering that Japan's sea trade was threatened by Russian fleets for five of the 1905 eight months this result is more than interesting—it is remarkable.

WALTER J. BALLARD.

THREE CRUISERS NEARING COMPLETION.

San Francisco, Dec. 6.—The three big cruisers now lying alongside of each other at the Union Iron Works, San Francisco, are rapidly nearing the finishing strokes. It will be only a short time before they will become valuable acquisitions to Uncle Sam's already great fleet of dogs of war.

The protected cruiser Milwaukee will be the first of the trio to be completed, and will be ready to make her official trial runs early in April. She is an enlarged type of the Olympia (Dewey's famous flagship), whose career so far has given great satisfaction. The Milwaukee is built practically, on the same lines as the Olympia. The work on the other armored cruisers—South Dakota and California, is being pushed rapidly forward, and their trial trips will follow soon after that of the Milwaukee. It was originally intended to complete the South Dakota first, as she was launched in advance of the other two cruisers, but it was finally concluded by the government to finish the Milwaukee before the others. However, the work on the three has kept nearly abreast in the later stages.

The navy department has selected the names Octopus, Viper, Cuttlefish and Tarantula for the new submarine boats building at the yard of the Fore River Company at Quincy, Mass. The names of the colliers Erie and Ontario have been changed to Vestal and Prometheus and the two new tugs building for the navy will be christened the Patapsco and Patuxent.

The Illinois Steel Co. is extending and equipping both its North and South docks with Hoover & Mason type of unloading machine.

ENGINEERING IN THE NAVY.

Attention is very forcefully called to critical condition of engineering in the United States in the annual report of Rear Admiral Rae, Chief of the bureau of steam engineering. He refers to the accident on the gunboat Bennington and says:

"Five and one-half years ago a momentous step was taken regarding the performance of duty in the navy. A whole corps of specialists was virtually abolished, and the duties performed by these specialists were transferred to the line. The intent of the so-called 'personnel bill,' the instrument by which the congress authorized this change, was that all the younger officers of the engineer corps, the corps in question, were to perfect themselves in seamanship, gunnery, and navigation, and were thereafter to perform both line and engineering duties indiscriminately, and at the same time the younger officers of the line were to perfect themselves in engineering and thereafter likewise perform indiscriminately the joint duties. The older officers of the engineer corps, although transferred to the line at the same time, were for obvious reasons to continue in the performance of engineering duty only. Thus eventually the line would be wholly composed of officers fitted to perform all duties connected with the movement of ships.

"The younger officers of the engineer corps were given two years in which to qualify for these new duties. How well they did it the records of the examining board and the fitness reports on officers bear striking testimony. As all midshipmen at the Academy had been given for years excellent practical instruction in engineering, no examination, other than that required for promotion, was demanded of them for qualifying for the performance of these joint duties. The intent was, however, that they should be ordered at once to the performance of this duty in subordinate capacities, as assistants of the older engineer officers. Owing to the absence of specific instructions to that effect in the personnel bill, combined with powerful adverse influences within the department, for three years absolutely nothing was done by the younger line officers in acquiring engineering experience, and later, owing to the large number of ships kept in commission and the scarcity of officers, but little in that direction was accomplished. So long as the older officers of the former engineer corps remained available for service at sea, supplemented by a new body of warrant officers called warrant machinists, the engineering duty of the fleet was properly performed. Credit must not be withheld also from a few officers of the line who by their own personal exertions perfected themselves in engineering, and served, or are serving, with marked efficiency in most responsible engineering positions afloat. The older officers of the late engineer corps are rapidly disappearing from active service. In my last annual report I stated that there were sixty-six such officers at that time. The number has since been reduced to forty-three, and were it not that the services of certain retired officers are available, the Bureau would already be experiencing great difficulty in finding officers for the various responsible positions both on shore and at sea.

"So few officers of the line are taking up engineering seriously that the situation is becoming alarming. That the department must do something to relieve this situation, and that something at once, is only too obvious to the most casual observer of present conditions. Were the country suddenly plunged into war the navy would find itself in no condition to win battles. As necessary as good markmanship is the ability to carry our guns to the firing line and to keep them there amidst the havoc created by modern ordnance, and this will never be done with amateurs in charge of the machinery. That line officers can become good engineers has already been proved, but they must have experience to become so, and that experience must be acquired in subordinate positions. No young officer out of the Academy but a short time, who would not be given charge of the deck except under the supervision of a senior officer, should be placed in charge of the engineer department of a ship, as has been done.

"Engineering logically belongs to the line, and the line should be made to perform that duty earnestly.

"In addition to the care and manipulation of the machinery of ships at sea, there are other duties which the engineer must perform and for which he must be fitted; these duties are the designing, inspection, and superintendence of construction of that machinery. The bureau holds, and it is not alone in the opinion, that the most successful designers of marine machinery are those who have had charge of it at sea. It therefore considers it most necessary that in the line of the navy there should be a certain number of engineering specialists—officers who devote all their time and attention to engineering, for in this way only can the most competent designing engineers be obtained. As before stated, the situation is critical, and something must be done. The bureau therefore submits the following plan for quickly supplying the navy with a body of efficient engineers:

"All younger officers of the line must be given engineering duty, and must be made to realize the importance of their responsibility. This duty must be at first in a subordinate capacity, and no officer should be given charge until his record shows his fitness for such duty. The examining board must be strict in its examinations for promotion, and before the board engineering must rank with seamanship, gunnery and navigation.

"That in the line there shall be a number of engineering specialists, whose duty both at sea and on shore shall be engineering. These officers shall not perform duty at sea after reaching the rank of commander. A careful study of the necessities of the case has resulted in fixing the number of such officers at one in every ten above the rank of lieutenant, junior grade. These officers shall be recruited at the foot of the list of lieutenants—that is, when ten officers reach the rank of lieutenant below the last engineering specialist, the department shall order an examination to be held of so many of those ten who volunteer for the purpose of selecting one officer to be assigned permanently to engineering duty. In case there are no volunteers, that, by a careful scrutiny of the record and fitness reports, one of the ten be selected for assignment to engineering duty.

"That officers so selected shall be given a course in higher marine engineering for at least one year at some school of engineering of reputation.

"Immediately, that any officer of the line may request assignment to engineering duty permanently.

"The final result of the foregoing plan would give a body of engineering specialists in the line of the navy of about the following numbers and ranks:

Rear-admirals		2
Captains		7
Commanders		11
Lieutenant-commanders	33	26
Lieutenants	29	
		82

"Of this number, sixty-two—the lieutenant-commanders and lieutenants—would be available for sea duty, say 30 at sea at any one time. This would give a sufficient number in each fleet to have a thoroughly competent engineer as chief engineer of each of the larger vessels, and a sufficient number to enable the commander-in-chief at all times to have available officers qualified to act in any case in which expert engineering knowledge is necessary. These officers would have among their assistants the younger officers of the line acquiring experience, among whom would eventually be found those who would take up engineering permanently and become specialists themselves.

"The bureau believes that such a plan, systematically carried out, would soon furnish the service with a body of competent engineers, and would place engineering where it properly belongs, in the line of the navy.

"So much has been written in the public press advocating the establishment of a separate corps of engineers, similar to the one abolished by the personnel act, that it is deemed advisable to state the views of the bureau upon that question.

"The bureau is opposed to the formation of a separate corps of engineers in the navy for the following reasons:

"1. Engineering, as the means of propulsion of ships, logically belongs to the line.

"2. Marine engineering of today demands for its votaries as high rank and as great consideration as that of the most favored branch of naval science, consequently a corps of such officers would require a certain number of positions of high rank in order to insure a proper flow of promotion, and there are not enough such positions of sufficient dignity for high rank to render the formation of such a corps justifiable.

"3. The engineer force of a modern, high-powered ship of war is a large proportion of the entire crew of such a vessel, and it is contrary to the ethics of military discipline that so many of the crew should be under the orders and direction of two separate and distinct bodies of officers.

"4. There is a widespread prejudice throughout the service against the formation of a separate corps of engineering specialists, which prejudice cannot be ignored.

"5. The controversies and jealousies incident to two bodies of officers performing duties of which the line of demarcation is very vague, so happily removed from the service by the amalgamation feature of the personnel bill, would be restored.

"6. The efficiency of a separate corps would be no greater, if as great, as that by the proposed plan, based upon the principle that engineering belongs to the line."

GASOLINE MARINE ENGINE.

FROM THE STANDPOINT OF A BUILDER OF MARINE STEAM ENGINES.

The present situation as regards gasoline marine engines is peculiar—to put it mildly—although more apparant perhaps to those who make a specialty of building marine work than to others, even the majority of marine engineers failing to appreciate it. The statement of one of them, however, covering his views on the subject nearly hits it and is as follows:

"The gasoline marine business is surely in a bad mix and it looks as if most of the manufacturers don't know what a boat that is big enough to be good for anything, has to contend with, or what a complete outfit of driving machinery should consist of, and as to the "horse-power," I don't believe that one in ten has any idea of what it means, but rate their engines to compete with some other fellow, or beat him a little, and consequently bring about a lot of trouble by fooling a customer, even though they don't know that they are doing so."

While this expresses the views of some well-posted marine (steam) engineers and is unfortunately true, to a surprising extent, there are those building the gasoline engines who fully understand every detail pertaining to the make-up of a first-class outfit of marine machinery, and who must find it difficult to reconcile the rated power of their engines as compared to steam, or the actual power transmitted to the propeller or paddle-wheel.

Even if we eliminate a few hundred makes by cutting out the small "motors" entirely and therefore all of the two cycle engines, we have an assortment of different designs remaining that must be confusing to the intelligent buyer who is seeking for the best and is willing to pay a fair price; for "the best" gasoline marine engine of today is not so much a matter of individual opinion as the buyer might be influenced in believing through reading the various catalogues and listening to the "explanations" of the salesman. The engine itself or rather "the complete outfit of driving machinery" must stand on its own merits and every piece and part of each accessory as well as the engine itself, must be right, in order to insure that dependability which the practical user of steam machinery insists on. Above all other considerations it should be proportioned for and suited to character of service in which the boat is to be engaged. Most gasoline engines are designed for light, high-speed launches turning a small wheel, barely submerged, at a very high speed and then calculated as exerting a certain "horse-power," but when that engine is actually put to work in a fairly staunch hull and with a consistent size of working wheel properly submerged, there invariably follows a panicky inquiry as to "where has all the power gone?" It is simply a misapplication and a different type of engine with longer stroke and slower speed should have been used.

Very few have had the opportunity, and availed themselves of it, as the writer has, to keep continually in touch with the commercial value of medium size gasoline marine engines (compete outfits) as compared with steam, and the feature that has been the most noticeable during the past several years is the efforts, that would almost seem to have been made purposely by the gasoline engine builders, as well as verbally, in offering their product as being practically automatic, requiring little or no attention; always ready at a moment's notice; never any trouble; very economical and claiming about 50 percent more power than the engine could possibly transmit.

Perhaps this is natural in the evolution of a new power and the conditions under which so many thousand gasoline engines are "manufactured," but it was as noticeable twelve years ago as it is today, and would seem as though it were time to call a halt on such statements and offer not only a properly built and well equipped complete outfit of gasoline marine machinery suitably designed for the work it must do and at a fair working profit, but also inform the buyer that it does require intelligent attention and should always receive it, or otherwise that trouble may be expected. Furthermore, that the engine cylinders are of a certain diameter and certain length of stroke, and that the power it is able to transmit may easily be determined by him, or anyone sufficiently interested to figure it out, by simply multiplying the square of the diameter of cylinder by the length of stroke and working revolutions per minute, and then dividing by 15,000 for one cylinder engine, double it for a two cylinder and so on, for it has been determined through comparative tests—principally electric—that 15,000 is a conservative and therefore proper constant in use.

It would seem unnecessary to touch upon the now well known fact that the ordinary "manufactured" stationary gasoline engines cannot be turned into so-called boat engines by making a few changes on the main machine, any more than the stationary steam engine can be treated in that manner, although a few years ago it was persistently tried, with some profit to the seller, at a severe cost, however, to the user.

The machinery required is of that character that is designed and built to order to meet the requirements of each particular case, and not to offer a light high-speed gasoline outfit as suited to a heavy business boat, or vice versa, but to fit the case at a fair price and when that is done, and not until then, will the gasoline marine machinery be recognized as a practical working success.

LIVERPOOL SHIPPING LETTER.

Liverpool, Nov. 20.—Particulars are now obtainable of the Canadian Pacific Railway Co.'s new steamer Empress of Britain which was launched on the Clyde on Saturday last, Nov. 11, by Mrs. Piers of Montreal, wife of the general manager of the C. P. R. steamship lines. Her chief dimensions are: Length over all, 569 ft., breadth 65 ft. 6 in., and depth to upper deck 40 ft.; the tonnage being 14,500 tons, and the displacement 20,000 tons. In appearance the Empress of Britain is a very high ship, having four decks above the upper deck, and a topgallant forecastle, which it is calculated will keep her dry in the worst Atlantic seas. Deep (27 inches) V shaped bilge keels are fitted to prevent excessive rolling, so that she will be a very steady as well as a good sea boat. To ensure safety the hull is divided into ten watertight compartments, any two of which might be flooded and the ship yet remain afloat. Further there is a double cellular bottom extending from stem to stern. A balanced rudder is fitted with two under-water steering gears of latest telemotor type. The ship will have two funnels and two polemasts. The propelling machinery consists of two separate sets of quadruple expansion engines, aggregating 18,000 I. H. P., each set having four cylinders working on four cranks balanced on the Yarrow, Schlick, and Tweedy system, which reduces vibration to a minimum. The propellers have each four blades of manganese bronze. There are nine boilers of the ordinary multitubular type in two watertight compartments, six double-ended with eight furnaces, and three single ended with four furnaces. The furnaces are fitted with forced draft, and the working steam pressure is 220 lbs. to the square inch. In all there are eight decks, boat, upper promenade, lower promenade, shelter, upper, main, lower and orlop. At the fore end of the boat deck is a large deckhouse with, to quote the builders' description "a space in front the full width of the ship reserved for the navigation of the ship," in reality the navigating bridge, protected by a high bulwark. The central and foremost part of this deckhouse is the wheelhouse, with the charthouse immediately behind it. The rest of the deck-houses includes the captain's quarters, and those of all the other navigating officers. Railed off at the after end of this deck is a space with shelter for bad weather, arranged as a recreation ground for firemen and other members of the crew. On the upper promenade deck, the fore part of the deck-house contains a group of staterooms with their own own baths and lavatories; then comes the entrance to the grand staircase, and aft of this another group of staterooms equally complete in all respects. Further aft is the music-room, the fore and aft sides of which form recesses. In the line of the deck-house and aft of the music room, there are six staterooms on either side, then another recess in the exterior line of the deckhouse and four more state-rooms on either side, with two staterooms filling in the end of the structure. The disposition of these staterooms is described thus fully in order to illustrate one of the features of the passenger accommodation generally, for the same idea is carried right through, viz, that each group of rooms should have its own set of bathrooms and lavatories, and be of such a size as to demand the services of a fixed number of stewards and stewardesses. It is calculated that this plan will enable one or more groups to be closed in the slack season, and thus simplify working and effect a saving. The deck space is of course completely covered in by the boat deck, and the recesses in the line of the deckhouse afford fine protected positions for deck chairs.

The lower promenade deck, unlike the upper, extends right aft to the stern of the ship. The fore part of the deckhouse on this deck contains the library the after end being occupied by the first-class smokeroom, with a large verandah. The staterooms on this deck and the upper promenade deck include a large variety for one, two or three passengers, some ensuite with private bath-rooms, and will be fitted up with the greatest luxury and variety of decorative treatment. There is a small house on this deck for a wireless telegraphy installation.

The saloon is 58 ft. long, by 62 ft. wide, and will, to be exact, seat some 296 persons. The panelling will be in mahogany, with carving in dull gold, and the seats will be upholstered in crimson leather. The special feature will be a number of small horseshoe-shaped tables for five passengers arranged in alcoves at the sides. In the centre of the ceiling is a large oval opening in to the cafe on the deck above. By an ingenious and effective adaptation of the design to the requirements of ventilation, the opening is continued through the music room to the boat-deck, where there is a powerful centrifugal fan exhausting the air. The cafe may be described as a straight-forward room, sumptuously appointed, but in keeping with its practical purpose, which is to supply light refreshments at any time throughout the day. The music-room, with its very fine dome springing from the great central column, its cosy corners and cheery fireplace, is in keeping with its more esthetic ends. The decoration treatment of the music room is throughout bold and original. As regards the particular woods to be employed in the various public rooms, the library, will be framed with rich mahogany, the cafe will be panelled with waxed Italian walnut, and the smoking-room with slightly fumed oak. The staircase will be in light-colored polished teak, and lighted overhead by a large dome.

To return to the shelter deck, between the after end of the first-class saloon and the second-class saloon are collected the galleys, pantries, sculleries, bakeries, stores, etc. for the entire ship, so that the serving of all meals radiates from this common centre. Hoists supply the various dining saloons with all their requirements, as well as bring supplies of all kinds from the stores in the hold.

The second-class saloon is a very fine apartment, fitted with mahagony, capable of seating 300 persons, with eight side tables in bays, each seating eight persons. The social hall adjoins the saloon, and between this and the stern there is an open deck space, with a deck-house right-aft containing the second-class smoke-room and hospitals for male and female passengers.

It is interesting to add another interesting feature in the designing of this ship. Corresponding with doors in the engine-room casing are watertight doors in the sides of the ship, so that engineers and firemen can walk on board direct from the quay to the engine room. There are other watertight hinged doors in the ship's sides of still more interesting construction and purpose. These each open into a sort of chamber some seven feet square, the fore and aft and top sides of which alone are solid, the inside and the bottom, like the outside, being furnished with a watertight door. The door opening into the "floor" of the "chamber" communicates with a spare bunker, which will be filled with coal on the outward journey, and used for cargo on the return. These stores can be passed in and out of the ship, or the spare bunker can be loaded or unloaded without affecting the adjacent parts.

In the all-important matter of ventilation, the Empress of Britain will leave nothing to be desired. The Thermo tank on the "Stewart" principle has been fitted throughout, so that there will be a comfortable temperature and perfectly fresh atmosphere everywhere.

The Empress of Britain is the first of the two liners which the Canadian Pacific Railway are having built on the Clyde, both of which are to be ready for service next spring. The second, the Empress of Ireland will be launched from the same yard in January next.

In the Suez Canal bulletin dated Nov. 12, appears the speech of the President at the banquet given by the British directors to their fellow members of the board, to celebrate the majority of the London Committee which was created in 1884. Prince Auguste D'Arenberg replying to the toast of his health said he had never missed an opportunity of showing the advantages the company had derived from its cooperation with the London Committee and all their foreign colleagues. They had not forgotten that if it was to the genius of Ferdinand de Lesseps and to the capital he found in France that the Suez Canal owed its existence, it was intended to be and to remain international. The great highway between the Mediterranean and the Red Sea was created for the use of all the nations of the world, who were all treated by them on a footing of absolute equality. Speaking of improvements that had been introduced, he said if the 91 millions that had been spent since 1885 to facilitate the maritime traffic, independently of other expenses, deserved some little gratitude on the part of their customers, he could assure them that they had resolved not to pause in such an excellent course. Already great works had been commenced to deepen and widen the canal so as to permit Port Said to receive any number of steamers. A sum of 30 millions will be expended to carry out those works. They all knew well the generosity of shipowners. They were aware that their principal aim was to satisfy the merchants who trusted their merchandise to them, and that all other questions only possessed in their eyes a somewhat secondary interest. But on their side it would be easy for him to prove that, although they never lost sight of the interests and advantages of shipowners. Moreover, it appeared to him to be absolutely impossible to separate the interests of shareholders from those of shipowners, and the attacks on them that had not been wanting of late, would not prevent them from rendering the passage through the canal more and more safe, more and more rapid, and less and less costly, by degrees as their receipts would enable them to do. The most glorious and prosperous undertakings passed sometimes through periods of depression and gloom, even in Egypt. Recently their sky had been obscured by a cloud which took the form of an ugly boat, filled with dynamite. For several days they were embarrassed as to the means of getting rid of that dangerous visitor. They ended by projecting it into the air to a respectable height, and when it came down, they perceived that it was not such a terrible obstacle as it had appeared. The experience they had had with the Chatham served at least to exhibit the merits of their excellent staff, and to find in all those persons with whom they had sought for counsel and opinion a cooperation for which they were profoundly grateful. The explosion of the Chatham also proved that the removal of obstructions in the canal could be promptly effected even under the most unfavorable conditions. Therefore when he saw a journal examine the hypothesis of the blowing up of a ship for the purpose of blocking the canal, and declare that it would be prudent, in order to avert such an eventuality, to make a second canal, he was somewhat astounded. It seemed to him that it would not be much more difficult to blow up two ships than one, and the sum that would have to be expended in digging a second canal would not in any way remedy what it was intended to prevent. The real remedy, as he had already indicated, was to make the present canal wider and deeper, and to possess the necessary plant to avoid any obstruction.

The Baltic and White Sea Conference of shipowners held its first sitting on Thursday, Nov. 16. After some discussion the rules drafted by the committee for the constitution of a permanent association under the name of the Baltic and White Sea Conference were adopted. Copenhagen will be the permanent seat of the association, but the annual conferences which will take place in the autumn will be held at some town to be fixed each time beforehand. Each country is to be represented on the managing committee, consisting of 24 members, in proportion to its tonnage engaged in the Baltic and White Sea trades, with a maximum of three members for any one country. Messrs. Salvesen, (Leith), Cairus, (Newcastle) and Little, (Hull) were elected the British members of the committee. M. Carl, of Copenhagen, was appointed president of the association, and W. Cairus, of Cairus Noble and Co., Newcastle, was appointed vice-president. A discussion on the questions of minimum freights for the ensuing Baltic season, and on a uniform Baltic coal charter for the east coast of England and Scotch ports followed.

I have made reference in one or two of my recent letters to the enormous amount of shipbuilding now going on in Britain, and this week the London *Times'* marine insurance correspondent says the attention of the more far sighted shipbuilders is being anxiously directed towards the enormous increase in the output of new cargo-carrying steamers. During the last four or five weeks more than 100,000 tons a week of steam tonnage has come up for classification by Lloyd's Register, and it is said that last week showed the record quantity of 120,000 tons. In other words, new steamers are being added to the register at the rate of 5,000,000 tons per annum, or more than three times the normal rate. It is estimated that an annual output of only about 1,500,000 tons of new steam tonnage is needed to supply wastage and the requirements of trade. There is nothing in the present, and prospective state of the shipping trade to justify the immense increase of tonnage with which the trade is being threatened.

The first election of ratepayers to the Clyde Navigation Trust, as reconstituted by recent Parliamentary decisions, took place at Glasgow on Nov. 16. There were in all twelve vacancies to be filled, three of which occurred in the ordinary course, and nine being additional owing to the increased representation of the ratepayers. The following were the successful candidates in order of the number of votes received: Mr. John W. Primrose, merchant; Mr. Arch Colville, steel manufacturer; Mr. Arch. Robertson, merchant; Mr. F. S. Anderson, shipowner; Mr. H. Rateburn, shipowner; Mr. R. Calder, timber broker; Mr. Robert Harper, shipowner; Mr. James Rowan, engineer; Mr. J. S. Kinghorn, merchant; Mr. J. S. Dunn, timber broker; Mr. W. S. Anderson, oil refiner; and Mr. G. W. Service, merchant and shipowner, the unsuccessful candidates were Mr. R. J. Dunlop, shipowner; Mr. Robert Moorhead, produce broker; Mr. J. C. Buchanan, shipowner, and Mr. W. J. Kerr, salt merchant.

A. Reuter's telegram from Hamburg says that owing to the recent establishment of new steamship lines at Bremen, all the large shipowners here have formed a protective combine. A new shipping company has also been formed which, from its origin, will probably bear the name of "The Syndicate Shipping Company." The fleet of the new company will for the present consist of ten freight steamers of from 4,000 to 8,000 tons, and it is to be increased by three steamers every year. The ships are to be placed at the disposal of any shipping company belonging to the combine if such shipping firm is attacked from outside, for the purpose of fighting the competition on conditions which are equivalent to the cost of free transfer

SEA GOING MOTOR LAUNCH.

In *Engineering* of London for Nov. 3, 1905, is described a sea going motor launch which was built by Messrs. Dickson & Halliday, of Southampton, England. The machinery was constructed by Messrs. Legros & Knowles, of Willesden Junction, London. The principal dimensions of the boat are as follows:

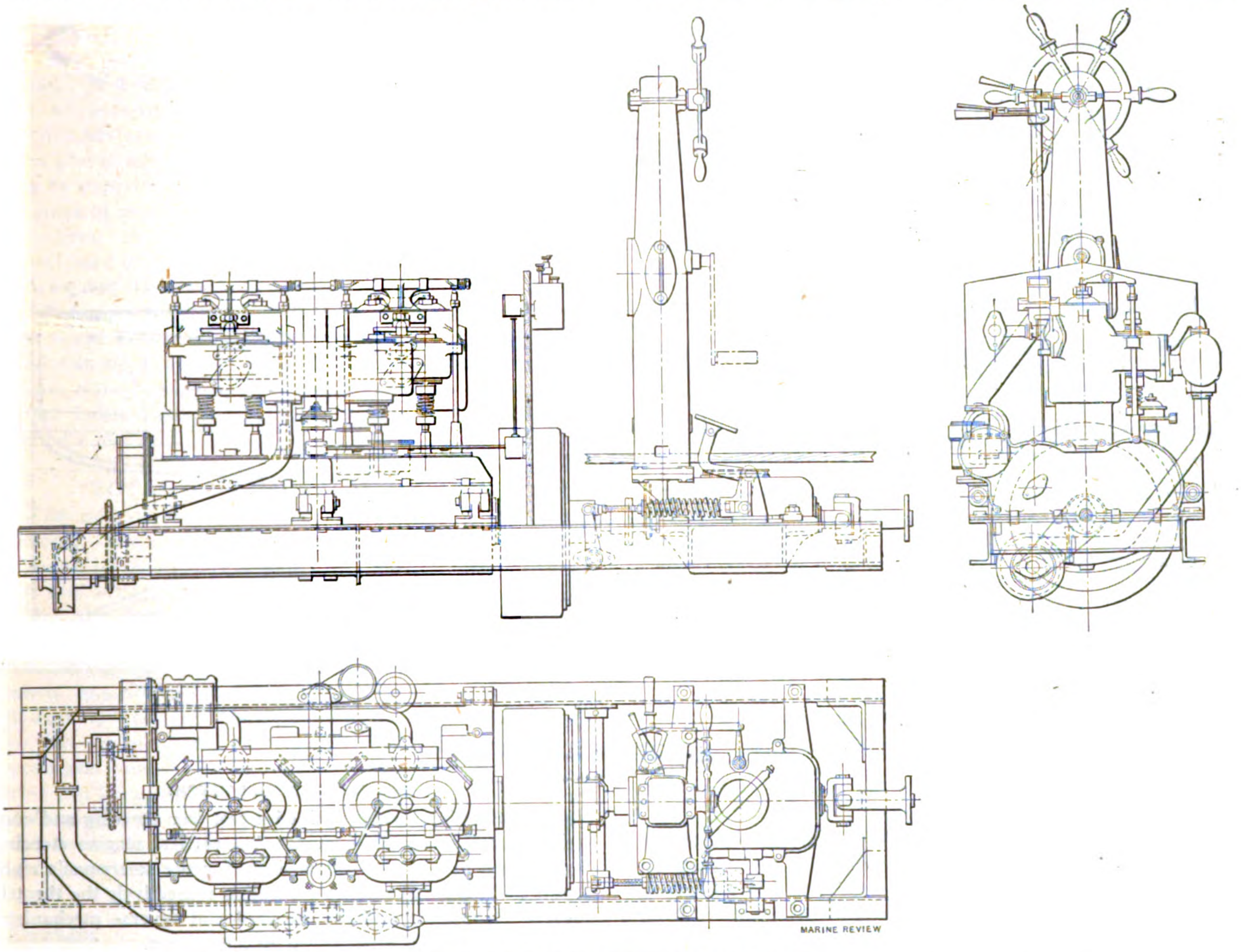
Length over all 30 ft.; Water line length 29 ft.; Extreme beam 6 ft.; Water line beam 5 ft. 8 in.; Depth amidships 3 ft. 8 in.; Freeboard, forward 3 ft.; Freeboard amidships 2 ft. 1 in.; Freeboard aft 2 ft. 2 in.; Extreme draught 2 ft.; Displacement with crew 2 tons; Area, midship section 4 sq. ft.; block coefficient .451; Prismatic coefficient .620; Barke horse power 24; Revolutions per minute 800.

In the design of the boat speed was a secondary consideration, the seagoing qualities, handiness being kept prominently in mind. The boat will accommodate ten persons, and provide ample storage space in the forward compartment. The hull is of pine planking 5/8 inch thick with teak top strake. The boat has for its entire length on the inside an American elm keel and an Oregon pine keel on the outside, which forms the principal girder of the boat's frame. It is carried from the stem to within 5 ft. of the stern. It is 3 in. thick throughout and has a depth of 15 in. at the after end.

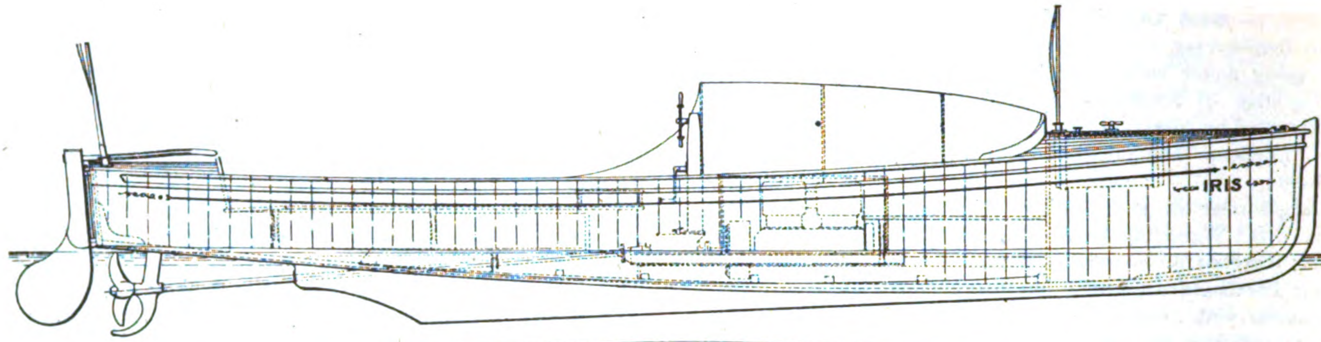
The boat is propelled by a petrol engine of the four-cylinder type. The cylinders are 4¾ in. diameter by 4¾ in. stroke. The engine is designed to develop 24 H. P. at 800 revolutions. The inlet valves are mechanically operated and are situated in the cylinder head. They are driven by rocking levers in the same cam shaft that operates the exhaust valves. On the opposite of the engine there is a second cam shaft which operates the mechanical make-and-break ignition device. In addition to the mechanical ignition there is also a high tension ignition device provided for use in case of emergency. This was done in order to eliminate the chance of motor stoppage, due to ignition trouble in a seaway.

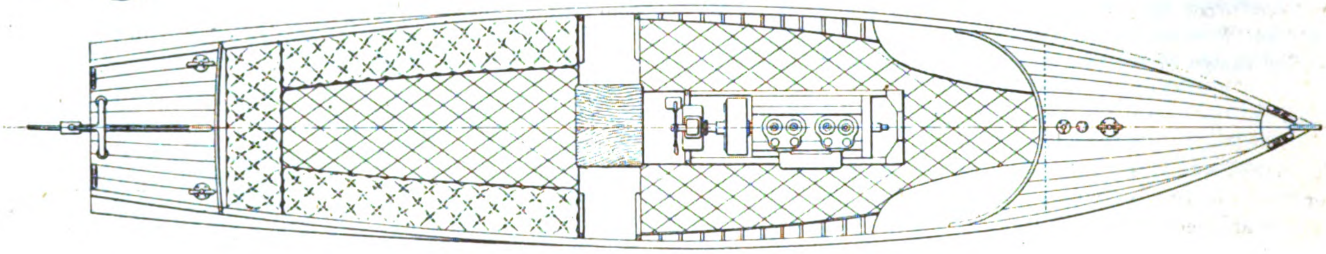
The engine is provided with large bearing surfaces for the main bearing and crank pins; the mean pressures on these are kept as low as in standard marine practice, and therefore far lower than is usually the case in petrol engines. The engine is extremely accessible. It is held to its bed plate by three lugs on each side in the form of hinge joints, which may be plainly seen underneath the cylinders in the illustration. By means of these hinge joints it can be swung to one side or the other to get at the big ends of the connecting rods or the main bearings. Two detachable inspection doors are fitted to the base chamber and hand holes giving access to the main bearings. The cam shafts are held to their bearings by caps and these bearings can be removed from the rest of the engine without disturbing the cylinders or base chamber. The crank shaft is also held up into the engine bed so that when the engine is swung on one side, and the oil bath casing removed, the big ends and main bearing are immediately accessible for adjustment.

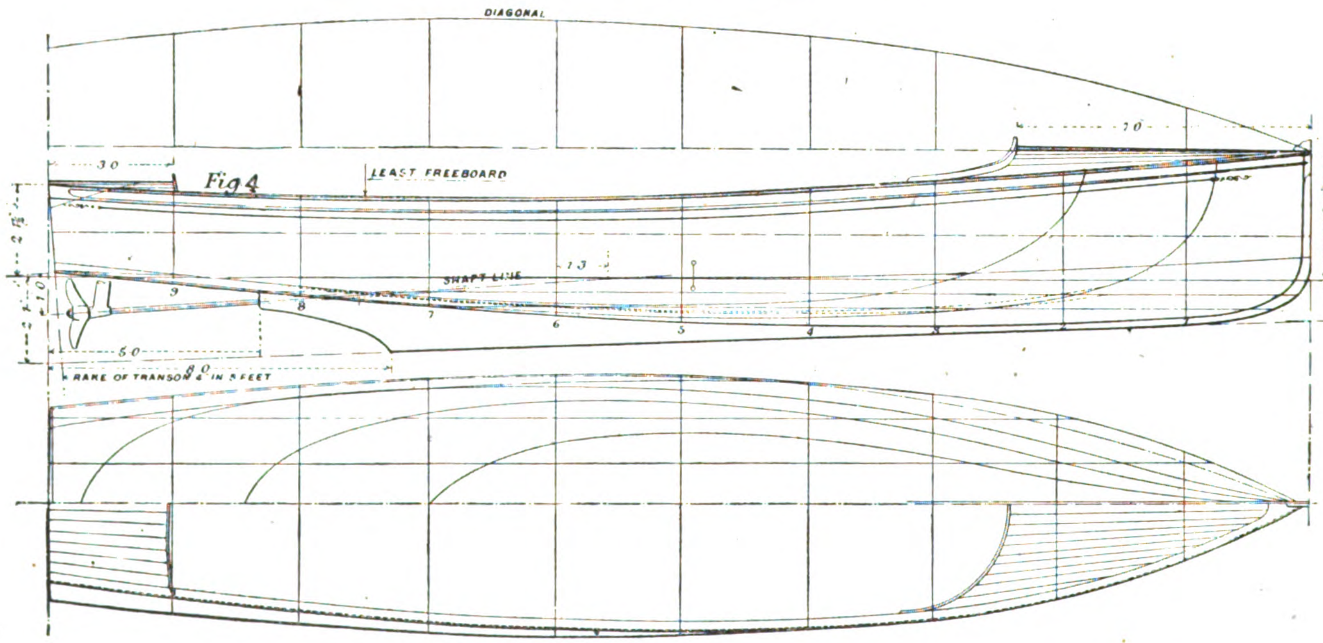
Fuel is supplied to the carburettor by gravity from a 10 gallon tank in the fore compartment of the boat under the turtle deck. A second fuel tank of 21 gallons capacity is carried under the main thwart, and the fuel contained in this tank can be pumped into the forward or running tank by a semi-rotary hand pump. By means of the design of the carburettor, which gives a positive mixture for every position of throttle opening, the engine will run and pull steadily at all speeds from 140 revolutions upwards. The torque is practi-

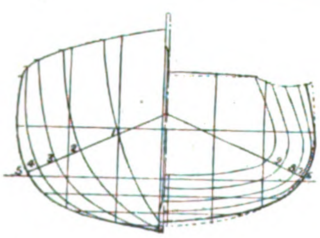


MACHINERY OF SEA-GOING MOTOR LAUNCH.









cally constant throughout the range.

Water circulation through the engine is maintained by a centrifugal pump which is carried low down forward and driven direct from the crank shaft by a roller pin. The water is delivered first to a water-cooled exhaust pot carried close to the exhaust outlet, and from these proceeds to the engine jackets, and afterwards to the outlet of the boat.

The engine valves are of large diameter and are made from 25 per cent nickel steel. The crank shaft is of chrome-vanadium steel forging. The power is taken from the engine through a leather faced cone clutch, which is engaged by an adjustable coil spring and disengaged by a pedal. This clutch transmits the power to a small gear box giving a forward and reverse gear by means of three mitre bevels and sliding sleeve with dogs, which enables the two shafts to be dogged together, or the power transmitted through the mitre wheels. The power is transmitted through the bevel wheels only when running astern. The gear box forms an oil tight case in which the beveled gears run, and which also lubricates the large phosphor bronze bearings. The box also has a platform cast on it to which is fixed a cast iron steering and control column. On this is mounted a vertical marine steering wheel, and in a convenient position for the steersman's right hand are two small handles controling respectively the throttle of the carburettor and the forward and reverse mechanism. The starting gear is also carried on the column.

SEA-GOING MOTOR LAUNCH.

The after end of the engine housings forms an instrument board upon which is placed a pump-lubricator. This is driven from a worm on the commutator spindle and delivers lubricant in quantities proportional to the speed of the engine. The two switches for magneto and high tension ignition, the induction coil for the latter and the advance for both ignitions are also placed on this board. After the engine has started the ignition may be advanced and left without further adjustment during the run. This enables the whole control of the boat to be managed by one man at the steering column, who can restart the motor with great facility without removing from his place. The engine is placed on its bearers with the crank center line horizontal so that the oil in the bottom half of the crank case may be equally distributed to the forward and after pairs of cylinders. This necessitates a Hooke's joint behind the gear box to connect with the tail shaft. The joint is made with the center line of both pairs of pins at the same plane, the pins being of nickel steel and run in phosphor

bronze bushes. The tail shaft is of delta metal and is fitted with two ball bearing thrust blocks and a gun metal three-bladed 17-in propellor. The entire installation of the engine, gear box, steering column, and control is lined up and fixed to a bed plate consisting of 4 inch channels as shown in the illustration; thus making a complete unit in itself which can be fitted in a boat without the more difficult and unsatisfactory operation of lining up in place.

TWO MORE STEAMERS FOR CLEVELAND CLIFFS.

The Cleveland Cliffs Transport Co. closed contract this week with the Great Lakes Engineering Works of Detroit for two 10,000-ton steamers to come out next July and August. The steamers are to be 550 ft. over all, 530 ft. keel. 56 ft. beam and 31 ft. deep, but there is a stipulation in the contract that the dimensions in so far as one of the steamers is concerned, may later be changed. They will be built upon the arch system of construction, with side tanks. In letting this contract, the company has stipulated for triple-expansion engines of somewhat greater power than it has been customary of late to put in lake steamers. The Cleveland Cliffs Iron Co. is especially prompt in profiting by experience, and the decision to give the new vessels engines of greater power is influenced by the lesson of the late great storm on Lake Superior, when it was clearly manifested that the great steamers had not sufficient power to care for themselves in a storm of such violence. President Antonio C. Pessano and Sec'y John R. Russel, of the the Great Lakes Engineering Works, were both in Cleveland this week, arranging the details of the contracts. This makes a total of six bulk freighters and a car ferry that the Great Lakes Engineering Works has under order for next season's delivery.

TOTAL MOVEMENT OF IRON ORE.

The ore shipments for 1905 have exceeded all expectations. The total movement to Dec. 1 has been 33,071,844 tons, an increase of 12,211,624 tons over the season of 1904. To this total of the present year, however, must still be added the December shipments, which will approximate 500,000 tons. The movement this year will therefore be 6,000,000 greater than the record-breaking year of 1902, when 27,500,000 tons were moved. To these figures, of course, must still be added the total movement by rail, so that the maximum movement for 1905 will probably be 34,000,000 tons. The astounding significance of these figures can be appreciated by looking backward a few years. Following were the shipments by ports during November and during the season to Dec. 1, with shipments for last year given for comparative purposes:

	Nov. 1904.	Nov. 1905.	To Dec. 1, 1904.	To Dec. 1, 1905.
Escanaba	554,991	630,463	3,506,923	5,176,385
Gladstone	....	....	480	....
Marquette	318,209	294,040	1,866,891	2,925,250
Ashland	367,742	420,346	2,269,987	3,460,120
Superior	649,809	408,827	4,132,064	5,043,234
Duluth	628,961	871,730	4,574,012	8,767,706
Two Harbors ..	683,349	649,823	4,509,872	7,699,149
Total	3,203,061	3,341,229	20,860,220	33,071,844
1905 Increase....		138,168		12,211,624

MR. W. H. BECKER ORDERS FREIGHTER.

Mr. W. H. Becker gave a contract to the American Shipbuilding Co., for a freighter to come out July next. The new steamer will be built at Cleveland, and will be 440 ft. over all, 420 ft. keel, 52 ft. beam and 28 ft. deep, and will carry 7,500 tons of ore. She will have triple-expansion engines, 22, 35 and 58 in. cylinder diameters, by 42-in. stroke. She will have two Scotch boilers, 13 ft. 9 in. diameter and 11 ft. 6 in. long, allowed 170 lbs. pressure. She will be built on the arch system of construction, but her water ballast will not extend along the side, being confined purely to the bottom.

CHICAGO GRAIN REPORT.

Chicago, Dec. 5.—Grain freights are closing the season quietly here at 2¼ cents Buffalo corn and some hold at Buffalo business reported at 2¾ cents per bu. The shipping of the past week was light and thus distributed: Via all rail lines of flour, 113,095 bbls.; wheat, 188,630 bu.; corn, 1,037,824 bu.; oats. 1,484,537 bu. and barley, 280,074 bu. And via lake to Buffalo and other American ports of flour, 72,300 bbls.; wheat, 402,700 bu.; corn, 317,000 bu. and oats, 80,000 bu.

The navigating of wooden hulls expiring today by reason of insurance limitation it looks that prompt chartering will not be continued to any extent. Nevertheless, cargo underwriters are disposed to support any final shipping effort by extending insurance on approved vessels sailing up to midnight of Dec. 8 at special rates. Interest is turning to winter storage and for the most part shippers figure upon an active call for vessels shortly after Jan. 1. No rates have been suggested as yet, but there is promise of a heavy corn movement to Lake Michigan elevators, whereas present indications point to a comparatively light supply of vessel capacity. Last year the visible supply, exclusive of liners, aggregated closely around 22,000,000 bu.

Lake and rail shipments.

	This Week	Last Week	Same Week last year
Wheat	591,330	230,479	525,680
Corn	1,354,824	1,353,674	2,302,253
Oats	1,564,537	2,175,156	826,009
Rye	15,995	25,302	17,709
Barley	280,074	268,501	140,362
Total	3,806,760	4,053,112	3,812,013
Flour	185,432 (Bbls.)	171,619	121,056

	Shipments since Jan 1, 1905.	Same Time last year
Wheat	12,840,984	16,714,917
Corn	86,367,685	68,688,558
Oats	59,630,002	44,179,832
Rye	1,070,865	1,473,717
Barley	6,126,521	5,320,413
Total	166,045,057	136,377,437
Flour	6,765,921 (Bbls.)	6,697,731

Stocks of grain in elevators.

	This Week	Last Week	Same Week last year
Wheat	9,120,000	8,812,000	3,867,000
Corn	1,899,000	1,513,000	1,328,000
Oats	12,648,000	13,205,000	9,104,000
Rye	649,000	646,000	443,000
Barley	251,000	352,000	138,000
Total	24,567,000	24,528,000	14,880,000

TAKES FORMAL POSSESSION OF PLANT.

The Toledo Ship Building Co. took formal possession of the plant of the Craig Shipbuilding Co., at Toledo on Saturday last. The deal was entirely closed before noon. The officers are Alexander McVittie, president and assistant treasurer; H. S. Wilkinson, secretary; Lyman C. Smith, treasurer; Charles B. Calder, general manager; Frank E. Kirby, consulting engineer; Howard I. Shephard, cashier. Steps will be taken at once to make the plant capable of constructing and caring for the largest craft on the lakes.

COMMERCE OF SAULT STE. MARIE CANAL.

The statement of the commerce of the Sault Ste. Marie canals, prepared by the superintendent of canals, shows a total movement for the year to Dec. 1, of 43,000,473 tons. There is, of course, to be added to these figures, the December movement before the total of the year can be secured. This is by all odds the heaviest season that the canals have ever had.

MARINE REVIEW

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THERE SHOULD BE A "SQUARE DEAL".

The following is one of a series of editorials that will appear in the Marine Review during the coming winter, having direct and indirect reference to the requirements of our Merchant Marine:

Again the country faces another session of congress with all its turmoil and agitation, its conflict of selfish and national interests.

Among the few questions which by common consent are likely to occupy first place in the discussions this winter at the capitol, is the one that both political parties, in spite of their promises, have hitherto avoided definitely settling, namely, that of giving proper recognition to the requirements of the merchant marine of the United States.

Every president from Jefferson to Roosevelt has urged prompt action and at every national convention, Democrats have vied with Republicans in drafting upon their platforms the usual resolutions, and the platforms of that party which has, with but brief interruption, held sway for forty-five years at Washington, have been especially prolific in this respect. But with the exception of a few efforts, largely the work of individuals who consecrated themselves most loyally and unselfishly to this service, no regular policy seems to have been agreed upon or been made a part of that party's legislation.

The appointment, however, in the spring of 1904, of a non-partisan merchant marine commission, of five senators and five congressmen, was the first definite move made by congress. In many directions belittled at the time, this commission as a result of exhaustive work and intense application, aroused a measure of popular interest that was a surprise, not only to the commission itself, but to every one who followed its investigations.

Its report, accompanied by a bill, a number of the provisions of which were agreed to universally by the members of this commission, Democratic and Republican, has been before congress once, and with some slight modifications will be re-introduced at the coming session. This bill carefully avoids all those features which made previous legislation unpopular, and provides for certain measures which have met the approval of all those who have given the subject any disinterested thought. They are briefly as follows:

First. From a port of the Atlantic coast of the United States to Brazil, on steamships of the United States of not less than 14 knots speed, for a monthly service at a maximum compensation not exceeding $150,000 a year, or for a fortnightly service at a maximum compensation not exceeding $300,000 a year.

Second. From a port of the Atlantic coast of the United States to Uruguay and Argentine, on steamships of the United States of not less than 14 knots speed, for a monthly service at a maximum compensation not exceeding $187,500 a year or for a fortnightly service at a maximum compensation not exceeding $375,000 a year.

Third. From a port of the Atlantic coast of the United States to South Africa, on steamships of the United States of not less than 12 knots speed, for a monthly service at a maximum compensation not exceeding $187,500 a year or for a fortnightly service at a maximum compensation not exceeding $375,000 a year.

Fourth. From a port of the United States on the Gulf of Mexico to Brazil, on steamships of the United States of not less than 12 knots speed, for a monthly service at a maximum compensation not exceeding $137,500 a year, or for a fortnightly service at a maximum compensation not exceeding $275,000 a year.

Fifth. From a port of the United States on the Gulf of Mexico to Cuba, on steamships of the United States of not less than 14 knots speed, for a semi-weekly service at a maximum compensation not exceeding $75,000 a year.

Sixth. From a port of the United States on the Gulf of Mexico to Central America, on steamships of the United States of not less than 12 knots speed, for a weekly service at a maximum compensation not exceeding $75,000 a year.

Seventh. From a port of the United States on the Gulf of Mexico, to Mexico on steamships of the United States of not less than 12 knots speed, for a weekly service at a maximum compensation not exceeding $50,000 a year.

Eigthth. From a port of the Pacific coast of the United States, via Hawaii to Japan, China, and the Philippines, on steamships of the United States of not less than 16 knots speed, for a monthly service at a maximum compensation not exceeding $300,000 a year, or for a fortnightly service at a maximum compensation not exceeding $600,000 a year.

Ninth. From a port of the Pacific coast of the United States to Japan, China, and the Philippines, on steamships of the United States of not less than 13 knots speed, for a monthly service at a maximum compensation not exceeding $210,000 a year, or for a fortnightly service, at maximum compensation not exceeding $420,000 a year.

Tenth. From a port on the Pacific coast of the United States to Mexico, Central America, and the Isthmus of Panama, on steamships of the United States of not less than 12 knots speed, for a fortnightly service at a maximum compensation not exceeding $120,000 a year: Provided, That the requirements of this section as to the rates of speed shall be deemed to be complied with if said rates are developed during a trial of 4 hours' continuous steaming at sea in ordinary weather in water of sufficient depth to make the test a fair and just one, and if the vessels are maintained in a condition to develop such speed at any time while at sea in ordinary weather. This trial shall be made under the direction and supervision of a board of naval officers which the secretary of the navy shall appoint upon the application of the owner or owners of the vessel to be tested.

And so carefully has the bill been drawn as a result of the effort made to remove every possible objection to its enactment, that it would seem impossible to criticise any single feature, but there still seems to exist some doubt as to its immediate passage.

And why?

Simply, it is said, because of the principle involved and the expense incurred.

The inconsistency of refusing the benefits of governmental aid to one of the most important industries requiring American capital, American material and employing American labor is absolutely indefensible under any circumstances, but under the peculiar conditions surrounding the question at issue it is a thousand times more so.

Take as illustration the $38,000,000 paid out each year as postal subsidies to a few great railroad systems and not always even recommended by the post office authorities.

Think of the millions for which the whole country is taxed without complaint to pay for the restoration by irrigation of the desert lands of certain western states.

And then think of the value given to property in some favorite localities at the expense of the whole country by the passage of river and harbor bills carrying appropriation that in eight years have amounted to $122,327,159.

And to go further, the country is facing an organized effort on the part of our navy department to have built a number of great battleships and to increase the expenditure for naval requirements by many millions of dollars, and yet the reports of the naval officers, articles in the public press and leading magazines are to the effect that we do not commence to have enough American officers and seamen to care properly for the ships we already own; and it is well known that a large proportion of those who man our modern warships now owe their allegiance to foreign powers.

With all other large nations, the building of a navy is secondary to or is influenced somewhat by the extent of their merchant marine, and the merchant marine of these nations, on the other hand, makes it easily possible to find an ample supply of skilled officers and seamen with which to readily recruit its naval forces.

But in the face of these conditions, millions are being constantly appropriated for new ships, *while the total expense that would be involved by the passage of the commission's bill would be about one-half the cost of a single battleship*; and besides it is estimated that its passage would render it necessary and profitable to build immediately at least 100 modern steamships, all carrying the stars and stripes, all officered by American citizens and employing American crews.

In time of peace these ships would be as so many floating American industrial establishments, warehouses, and shops carrying the products of our farms, shops and mills to distant lands, familiarizing our people with foreign methods of handling and introducing American wares, educating a portion of our young men to represent our flag and its institutions in foreign lands and in a general way, blazing the path for a future industrial supremacy in foreign commerce that now largely because of the lack of these advantages is going almost entirely to other countries.

Which would be the greater advantage to our country in time of either peace or war, the one battleship or 100 fast ocean going steamships that could be depended upon for transportation service to carry war material and supplies, and better than all, furnish a reserve force of enthusiastic Americans with the sea habit sufficiently developed to supply the demand for the "man behind the gun?"

What a rank humbug for our short-sighted law makers to talk about expense.

Here we have the spectacle of taxpayers putting up $40,000,000 to purchase a right of way through swamps and over mountains, in a foreign land, in order that we may have the doubtful pleasure of building an enormous canal—for what purpose? To benefit solely the immense merchant marine and commerce of Great Britain, Germany Japan, Norway, France, Italy, etc.; but not to bring a return of one dollar to this country, its flag or its taxpayers. The cost of building the canal was to be 200 million, we heard at the beginning; then we were told, 300 million and never said a word; and it jumped successively and rapidly to 400; now we hear of 500 million of dollars as being about the right figure, to say nothing of the cost of operation and repairs, and the work has not yet been fully mapped out and no one living has any idea as to what the cost will eventually be.

And all because we are carried away, apparently, by an hysterical sentiment that is without parallel in the world's history.

If the canal is ever finished (and it is not likely it will be finished in twenty years, at least) it will never carry an American ship unless it is an occasional man-of-war, provided our policy does not quickly undergo a radical change; and the merchant marine of every nation but ours will be doing the world's business, which by then will have grown to mammoth proportions. And not content with sending out of the country, as we do now, hundreds of millions of dollars in gold each year as freight to foreign ship owners for carrying on American commerce, we are going to forge a chain around our own necks by taxing American citizens for the enormous sum necessary to further strengthen the trade, add to the wealth and increase the prestige of foreign nations, while our merchant marine remains extinct and American manufacturers and workingmen are robbed of their just share in what ought to be our great national undertaking and a phase of our national development and prosperity.

It is given as an excuse and a sort of a weak-kneed justification for all this that the canal is being constructed to aid American marine interests, but not a record exists of any suggestion ever having come from such an interest in any way; and it is not improb-

able that a certain influential American marine organization may yet adopt strong resolutions denouncing as a piece of wicked extravagance, the whole proposition.

The canal at Panama has been a nauseating scandal since its inception; it has made and unmade governments and reputations; and while it has been an American undertaking for only a couple of years, each succeeding month and week has brought a fresh crop of unsavory reports and scandals home to our own doors.

The appearance of the hypnotic and oleaginous promoter upon the scene, gold-bricked our impetuous law makers into an undertaking that is going to be a great white elephant for all time. It is a question if our over-zealous government officials have not already embarked the country upon an enterprise the expedience of which is questioned and the success of which is problematical.

The government of this country has no more right to squander American treasure and sacrifice American lives in this foolhardy scheme to help our marine interests, than the president of a great life insurance company had to use a portion of the trust funds placed in his care for the widow and orphan, in a dishonest effort to defeat a candidate for the highest office in the gift of our people.

It will cost not to exceed $4,000,000 a year to aid the entire merchant marine of this country on salt water in the ocean carrying trade upon the present schedule, and the expenditure will be a national investment in a hundred ways, affecting American interests through the vast ramifications of our industrial life, from our ore mines, furnaces, mills, shops, forests and farms, to the makers of the most minute mechanical device or nautical instrument that can be profitably made in this country; and our national law makers who are voting many times that amount without any expectancy of a return on the investment, and involving the country, perhaps, in complications that no one can now foresee, without any good reason, should do a little serious thinking or the country is likely to do it for them.

Our merchant marine does not require a $100,000,000 investment.

It does not need one of 200 million or 500 million.

It does not ask for a canal.

It should not be compelled to wait a century for simply justice.

But it is entitled to a "square deal."

Lake Superior's Great Storm.

The recent great storm on Lake Superior was probably the most violent of which there is any record. Certainly it is the most violent that has occurred since steel ships were employed in the bulk freight trade, which would, roughly speaking, be during the past fifteen years. It has always been thought that when one of the great modern freighters was out in the open sea that she could successfully withstand any gale that was likely to be encountered, but this gale was of such violence that the steamers, especially the light ones, were utterly unable to make headway against it. It would seem as though the great steamers had too low power for their bulk. The practice of the past two or three years has been to install in these modern steamers engines of low power capable of driving the vessel at about ten miles an hour loaded. They have hitherto proved themselves to be economical, satisfactory and capable of meeting all the conditions of the trade. But this was a storm that no master of a modern freighter had any expectation of meeting with. For instance, the steamer John Stanton, bound for Fort William with coal, worked her engines full speed ahead continuously for fourteen hours and during all that time went astern. They probably just about held her for she eventually reached Fort William without damage. The steamer Crescent City had both anchors out and her engines wide open, but for three hours and fifty minutes she drifted helplessly with the storm and finished up on the rocks of Duluth. Six times the captain tried to turn her around and six times he failed. It is impossible to determine at this time the exact property lost of the vessels that are total losses. There is such an enormous salvage in a steel steamer that total losses are rare. With the exception of the Owen, which foundered in the open lake, the only total losses are those of the Lafayette, Madeira and Vega. Several of the vessels will probably lie on the beach where they are from now until spring, but can at that time be repaired and put again in commission. Following is the list of vessels that suffered:

The steamer Mataafa, ashore at Duluth near ship canal; nine lives lost.

Steamer Lafayette, ashore at Encampment Island; one life lost.

Steamer Edinborn, ashore on Split Rock; one life lost.

Steamer Coralia, ashore on east side Keweenaw Point.

Steamer Wm. E. Corey, ashore on Gull Island, Apostle group.

Steamer Crescent City, ashore near Lakewood.

Steamer Isaac L. Ellwood, sunk in Duluth Harbor.

Barge Manila, ashore at Encampment Island.

Barge Madeira, ashore near Split Rock.

Barge Maia, ashore on the east side Keweenaw Point.

Steamer R. W. England, driven ashore on Minnesota Point.

Steamer Western Star, ashore near Fourteen Mile Point.

Steamer Bransford, struck on Isle Royale.

Steamer Monkshaven, ashore on Pie Island.

Steamer George Spencer, ashore near Thomasville.

Schooner Amboy, ashore near Thomasville.

Steamer Ira H. Owen, foundered off Outer Island; nineteen lives lost.

Steamer Vega, broken in two on Lake Michigan.

Steamer D. C. Whitney; steamer C. H. Warner; steamer Ferdinand Schlesinger; schooner Georgia; schooner Vinland; steamer Rosemount; steamer J. H. Outhwaite.

FATE OF THE LAFAYETTE AND MANILA.

The steel steamer Lafayette, towing the barge Manila, was driven ashore at Encampment Island. The crew of the Lafayette had lost all idea of their whereabouts in the blinding snow storm and had just signaled to the Manila to drop anchor, when the steamer struck the rocks and the Manila following at the end of her tow line

crashed into her stern. The barge then sheered off, but not before four men from the steamer had jumped aboard. The Manila struck broadside off the shore under some overhanging trees. Through these the crew climbed ashore and ran to the assistance of the crew of the Lafayette. The steamer had stranded some distance out and with the seas breaking over her from stem to stern, the crew were in great peril. One of the men on the Lafayette succeeded in throwing a small line into the trees and by means of this a great hawser was drawn to shore and made fast. Over this four of the Lafayette men crawled to safety. The fifth, Patrick Wade, the fireman, was making the trip when a sudden lurch of the steamer tightened the line and threw him high into the air. He dropped back into the surf and was drowned. A breeches buoy was then improvised and the remainder of the crew passed in safety. Reports indicate that the Lafayette will be a total loss.

WRECK OF THE CRESCENT CITY.

The steel steamer Crescent City was blown broadside on the rocks near Lakewood, one mile from the Duluth pumping station. The Crescent City was bound up light for Two Harbors and left the Sault on Sunday at noon. When the gale struck her she was blown across the lakes at great speed. So frightful was the force of the wind that though her anchors were out and her engine wide open going full speed ahead, the Crescent City nevertheless went astern. Six attempts were made to turn around, but at each attempt she listed so heavy that several of the crew were almost washed overboard. The fire-room force worked with all their might to keep up sufficient steam to hold her straight in the wind. Ten feet of water were let into her cargo hold, but nothing could prevent the boat from drifting. The proximity of the rocky shore was noted by the sound of the breakers before they could be seen, and the few minutes before the vessel crashed against them were full of awful suspense to the members of the crew. The vessel struck fortunately in a little cove not more than 100 ft. longer than herself, with sharp abutments of rocks, both forward and aft of her. Had she struck elsewhere a couple of hundred feet in either direction, she would have been dashed to pieces. It is to the friendly shelter of this tiny harbor that the members of the crew owe their lives. The Crescent City was cracked amidships in the shock, but it will not be a considerable operation to salve her.

CONDITION OF THE COREY.

The steamer Wm. E. Corey, the crack freighter of the Pittsburg Steamship Co.'s fleet, ran ashore on Gull island. Capt. F. A. Bailey's original telegram said that she went on easy but several tugs and steamers which have been making strenuous efforts ever since to pull her off would tell a different story. The explanation of this circumstance lies in the augmented depth of water piled up by the wind during the storm. The Corey, being under check and moving slowly went on lightly, but the water subsiding there or more ft., left her very securely imprisoned on the beach. Mr. Harry Coulby, president and general manager of the Pittsburg Steamship Co., took personal charge of the salvage operations of the Corey. The steamers Siemens and Marina of the Pittsburg Steamship Co.'s fleet, together with the tugs Crosby, Edna G. and Gladstone, were sent to the wreck, but their combined efforts were unable to dislodge the Corey.

FOUNDERING OF THE IRA H. OWEN.

The steel steamer Ira H. Owen, with a crew of nineteen men, disappeared in the great storm on Lake Superior. The last seen of the Owen was when she was sighted about 40 miles off Outer Island of the Apostle group by the steamer H. B. Nye, when the storm was at its height on Tuesday. The Owen was then blowing distress signals and seemed to be in a bad way. The Nye could not respond as it was all she could do to keep afloat herself. Later Capt. M. K. Chamberlain, of the steamer Sir Wm. Siemens, reported having passed, when 12 miles east of Michigan island, one of the Apostle group, a mass of wreckage consisting of chairs, stanchions, the top of a cabin and other debris. Floating in the midst of the wreckage were life preservers marked S. S. Ira H. Owen. The Owen was in first class condition and had 116,000 bu. of barley aboard. She was owned by J. G. Keith & Co. of Chicago.

WRECK OF THE MATAAFA.

Capt. R. F. Humble, master of the Mataafa, has told the story of the wreck of that vessel on the piers of Duluth harbor. When the Mataafa left Duluth with the barge Nasmyth in tow, the wind was fresh, but there was no sea to speak of. When about off Two Harbors, it began to snow and blow a gale, but the steamer continued on her course until 2 o'clock the following morning. The sea was then so heavy that the steamer started to blow around but with helm hard over and working the engines as strong as possible, she was headed to windward again. At 5 o'clock in the morning she started to blow around again. The helm was put hard astarboard, but it was impossible to get her headed in any more. The steamer was then in the trough of the sea. Capt. Humble then ordered the helm hard aport and let her come around before the wind. The steamer then continued back to Duluth. The captain would have made Two Harbors had it been possible to get the steamer headed into the sea. It was snowing so hard that he concluded he could not find the Duluth piers and so tried to get headed to windward again. He worked in that position about an hour without coming up to windward. The hatch bars had begun to buckle and the captain feared that the hatches would break. As the snow was now clearing he made for Duluth piers, after notifying the barge that he was going to drop her. He headed for the piers at full speed, the vessel steering very well until near the canal entrance when she seemed to come up in a monstrous sea and go down and hit the bottom which caused her to take a sheer to starboard. The helm was ordered hard astarboard, but she did not obey in sufficient time to prevent a heavy impact with the north pier. The captain then tried to steer her into the canal and rang the Chadburn to the engineer to work stronger, but the engineer answered that something was wrong and that he had stopped the engines. Capt. Humble never saw the engineer alive again. She pounded broadside on the pier and was apparently cracked in two about amidships. The forward crew were rescued by the life savers in the morning, but the after crew, nine men in all, had frozen to death during the night.

LOSS OF THE VEGA.

The steel steamer Vega, was totally wrecked on the east shore of Fox island during the great storm of last week. The Vega was bound down from Ashland to South Chicago with a cargo of iron ore and was caught by the great storm in crossing Lake Michigan. She brought up on Fox island in the accompanying snow storm and soon after broke in two. The crew managed to escape to the islands where they remained for two days before they reached the mainland. The Vega was built in 1893, and was valued at $105,000. She was owned by the Gilchrist Transportation Co. of Cleveland. Capt. A. M. Williams says that the Vega left Ashland in a snow storm but it experienced nothing unusual until Lake Michigan was reached. The seas then began to pound

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NAVAL ARCHITECTS AND MARINE ENGINEERS.

THE DISCUSSION UPON THE TURBINE PAPERS BY CURTIS AND SPEAKMAN WAS OF THE MOST ANIMATED AND VALUABLE CHARACTER.

In relating the financial condition of the Society of Naval Architects and Marine Engineers in the issue of November 23, it should have been clearly stated that while the total receipts for the year were $10,620.81 and expenses $9,611, leaving a balance on hand of $1,009.49 that $1,500 of the receipts of the year were invested in certificates of deposit drawing interest, so that the real balance for the year was $2,509.49. This makes the financial status of the society eminently satisfactory. Although eight deaths and thirty-one resignations occurred during the year, there were elected forty-three members, so that there was an actual gain of four in the total membership.

Probably the most important papers read at the sessions were the two turbine papers—one "Marine Turbine Propulsion," by Mr. Charles C. Curtis, and the other on "Marine Steam Turbine Development and Design," by E. M. Speakman, of England. Mr. John H. Macalpine, who with Admiral Melville went abroad at the instigation of George Westinghouse, related the results of his inquiries in the most guarded language, but the inference was clear that he did not regard the turbine as a success. Mr. Speakman's paper, which was very exhaustive, will be given in full later. Before reading his paper, Mr. Curtis said:

"I am afraid my little paper will sound very insignificant and uninteresting after the very technical and elaborate papers, some of which have been read this morning, and one of which, on this interesting subject is to follow mine; but I think it might be interesting to state some of the results that we have obtained and what is being done in the application of this particular type of turbine to marine work."

Mr. Curtis' paper was as follows:

The first vessel to be propelled by steam turbines of this type, and the first vessel of any kind to be fitted with twin shafts and screws, and twin turbines independently controllable and reversible, was the yacht Revolution, built in 1902. This yacht had a length of 140 feet on the water line, beam of about 17 feet, a draught of 7 ft. and a displacement of about 200 tons, and was provided with two independent turbines of about 1,200 H. P. each, turning outward and designed to run between 650 and 750 revolutions under full speed conditions. The turbine casing, including the reversing mechanism, was only 5 ft. 10 in. in diameter and about 4 ft. long. The turbines were not designed to show any remarkable economy, but were expected to consume about the same amount of steam as an ordinary triple expansion engine under the usual conditions of service. This yacht was put into commission in the spring of 1902 and was kept in commission and used for exhibition purposes continually, with the exception of two months during one winter, for a period of a year and a half.

The practical operation of the turbines was in every respect most satisfactory and convincing, neither one ever having required any repairs of any kind, and the steam consumption was shown by torsion shaft test to be substantially equivalent to that of the ordinary triple expansion engine under average working conditions. The boat, however, failed to develop the speed anticipated, and it was a long time before we could find out why this was so. The impression seems to have got abroad among marine engineers that the failure of this boat to show a speed consistent with the high power provided was in the main due to a failure of the turbines to develop the necessary H. P. Such was not the fact. One of the turbines when driving the screw in the ordinary way, was subjected to a very careful torsion shaft test by Prof. James E. Denton, who, with Prof. Webb, devised and worked out an ingenious and accurate method of measuring the angle of twist of a specially calibrated length of torsion shaft introduced into the line shaft for this purpose. The tests showed that the turbines developed the full power expected, and that the steam consumption was about 17½ pounds per I. H. P. The results are given in the following table:—

POWER AND ECONOMY OF ONE TURBINE.

Number of steam passages in use.	Revolutions per minute.	Brake H. P., or H. P. delivered to propeller.	I. H. P. of equivalent piston engine.	Dry steam per I. H. P. of equivalent piston engine.
1	2	3	4	5
4	748.0	1,096.0	1,267.0	17.46
4	748.0	1,096.0	1,267.0	17.46
3	672.8	761.6	898.7	18.14
2	596.6	467.1	572.0	19.12
1	452.5	192.3	269.5	21.34
1 throttled.	265.3	95.7	146.2	24.67

The failure to get the expected speed, viz: 21 to 21½ knots under conditions where the boat actually showed only about 18 knots, furnishes another illustration of how easy it is to "fall down" in an engineering matter of this kind, even when the best knowledge and talent are availed of. In order to insure success we not only had the vessel designed by a well kown firm of yacht designers and builders who had previously built a yacht which was and still is the fastest yacht in this country, but we had the yacht's model tested in the government testing tank in Washington, and the screws were designed by a very distinguished authority in this country. Several sets of screws were built for the boat, the last set having a diameter of 4 ft. and a pitch of 4 ft. and having thin blades of well known form. From what is now known of the action of propellers of this character and from the fact that the turbines did develop the power expected, we have been led to conclude that the trouble with the Revolution was in her model, which, in the afterbody is very bad, her floor not being drawn out aft far enough. This view is confirmed by the best marine architects whom we have consulted about the matter and who have observed the wave action of the boat, which is very excessive, even at a speed of only 18 knots.

The reversing and manoeuvering capacity of the Revolution was even better than anticipated, and was very satisfactory. In a manoeuvering test made by a Board of the Navy Department it was found that when going ahead at full speed (about 18 knots) the boat was brought to a standstill in the water in 32 seconds after the engine room telegraphs were thrown over. The boat was used extensively about New York Harbor for a year and a half, and her reversing power was called into play to the utmost very frequently but it never failed to respond with the necessary power, and during the whole period of her use as a "demonstration" no trouble of any kind whatever was had with either of the two turbines.

Some time ago the Fore River Shipbuilding Company of Quincy, Massachusetts, at the instance of its very able and progressive president, Admiral Bowles, and after an investigation into the comparative merits of the two types of steam turbines available for the purpose, entered into

contracts for the construction of two large vessels to be equipped with twin independent Curtis turbines, which vessels, together with the turbines, the Fore River Company is now building. One of these is the U. S. scout cruiser Salem and the other is the Southern Pacific steamer Creole, particulars of which are as follows.

	Salem.	Creole.
L. W. L.	420 ft. 0 inches	415 ft. 8 inches
Breadth	46 ft. 8 inches	53 ft. 0 inches
Draught	16 ft. 9½ in.	25 ft. 0 inches
Displacement	3,750	10,160 tons
Horse-power	16,000	8,000
Speed	24 knots	16 knots

In both vessels there are two shafts and two screws with complete independent turbines on each shaft. In the case of the Salem the proposed revolution of the screw at 24 knots is 350; in the case of the Creole somewhere between 225 and 275. The space occupied by the turbines fore and aft (including the reversing mechanism) is only about half that occupied by the equivalent triple or quadruple expansion four cylinder engine and the weight is considerably less. In the case of the Creole the weight of the two turbines is, roughly speaking, about half of that of the equivalent quadruple expansion engine. The total saving in weight of the engines, shafting, propellers, etc., is very considerable. Each turbine is in the form of a drum shaped shell, built up in sections, having an outside diameter of about 11 ft. and an over all length of about 14 ft. Each turbine comprises 7 stages for going ahead and two stages for reversing. There is no end thrust due to the pressure of the steam in the turbine itself and the propeller thrust is taken up by the ordinary thrust block external to the turbine.

During the past summer the Vulcan Shipbuilding Company of Germany completed a turbine vessel called the Kaiser, which is fitted with two shafts and two independent turbines of this type. The turbines were built for the Vulcan Works by the Algemeine Eliktricitats Gessellschaft of Berlin, who are licensees under the Curtis Turbine Patents, and were designed by and built under the very able direction of Mr. O. Lasche, the technical director of the turbine works of the Allgemeine Company. The performance of these turbines and of the vessel on her trial trip was admirable, and reflects great credit upon Mr. Lasche and his associates, and also the designing engineers of the Vulcan Works, who assumed the responsibility of getting efficient screw action under the unusual conditions. The guarantees were intended to represent the performance of a first class 4-cylinder triple expansion engine and the ordinary slow turning screws which necessarily have a somewhat higher efficiency than the comparatively high revolution screws requisite for turbine propulsion. The actual figures guaranteed were a speed of 19½ knots, and a consumption during a 6-hour run of not over 4,700 kgs. of coal per hour, including all auxiliaries. Progressive speed trials were had up to 20.46 knots, the propellers turning at 655 revolutions per minute. During a 6-hour run 20 knots averaged on 4,060 kgs. of coal per hour. We have not yet ascertained positively what the H. P. developed was, but we understand that the shaft H. P. was measured by the use of a torsion shaft, and we understand on good authority that the indicated H. P. of the engines for the ship at 20 knots is estimated at 5,700. Whether this is derived from the shaft H. P. measurement or confirmed by the shaft H. P. measurement we do not as yet know. But if this figure—5,700 I. H. P.—sent to us is correct, the coal works out at 1.56 pounds per I. H. P., including all auxiliaries. The coal result is, if anything, better than these figures show, for during two hours the safety valves were blowing and the steam by-passing to the condensers. On a basis of the cube of the speeds the H. P. at 20 knots would be 8 percent greater than that at 19½ knots, and as the coal consumed at 20 knots was only .864 percent of that guaranteed for 19 knots, it would appear that at a speed of 19 knots the coal consumption would be just 80 percent of the amount guaranteed.

The dimensions of the vessel are as follows:

Water line length, 310 ft.

Beam, 38.2 ft.

Draught on trial trip, 9.74 ft.

Displacement, 1,890 tons of 2,240 pounds.

In order to test the manoeuvering and backing qualities of the turbines, which were entirely independent, another engine driven vessel belonging to the same line (the Hamburg Line) was brought to the spot for comparison, and it was found that the turbine ship was brought to a stop in the water in slightly less time than that occupied by the engine driven ship. I am informed that during the trials the turbines gave no trouble and their practical operation was entirely satisfactory.

Each turbine is built in the form of a drum shaped shell built in sections the shell having a length of about 11½ ft. and an outside diameter of a little over 8½ ft., the reversing apparatus being all contained within the same shell. The weight allowed for each turbine was 70 tons and the actual weight was 57 tons.

A very remarkable feature of the result seems to be the screw performance at the unusually high revolutions. Three or four pairs of screws were tried before the desired result was obtained, the turbines originally having been intended to run at 600 revolutions. The characteristics of the screw we have not as yet ascertained and cannot, therefore, state them, but it would seem from the excellent performance of the propelling machinery as a whole that the screws must have been surprisingly efficient in their action, considering the fineness of pitch involved.

Shop tests of the turbine to ascertain their H. P. economy had previously been conducted, the power developed being measured by a disc water brake with the following results:

With a boiler pressure of twelve atmospheres or 190 pounds abs. with dry steam and a vacuum of 28 inches the steam consumption per brake H. P. was 12.76 pounds at 600 revolutions and about 13.42 pounds at 500 revolutions.

The application of this type of turbine for driving electric generators has received an extensive development by the General Electric Company under the very able and energetic direction of Mr. W. L. R. Emmet, who early foresaw its advantages and who has introduced many new mechanical features in design and construction. One novel feature introduced by Mr. Emmet was the vertical shaft form. In this form the entire weight of the rotating parts, comprising the turbine wheels and the revolving, field or rotor of the generator, and amounting in the larger sizes to something like 75 or 100 tons, is mounted on an oil or water step bearing, which really is not a bearing at all, but a fluid cushion support under pressure sufficient to carry the entire weight, without permitting metallic contact. The success of this bearing in the face of the criticisms and predictions often made, has been quite remarkable. The total number of turbine units thus far shipped by the General Electric Company is about 290 and those on order about 200 more. These units vary in capacity from 15 k. w. to 8,000 k. w., more than 60 percent of them ranging from 500 to 8,000 k. w.

DISCUSSION ON MR. CURTIS' PAPER.

Mr. Curtis: I might add that the total horse power capacity that have been delivered or are under order is somewhere between 600,000 or 900,000 horse power.

Mr. F. Merriam Wheeler: I wish to ask Mr. Curtis what

is the minimum speed of a vessel that he recommends the use of turbines in, and also how small a horse power—with how small a horse power they have been found efficient; that is, how small the units of horse power can be made before the advantage of the turbine ceases to be of material interest.

Mr. Curtis: I think that is a very hard question to answer. In the uses of the turbine on land the advantages in the machine do not show up materially until you get into sizes of considerable horse power. We have not had enough experience in marine work to enable us to say at all from practical experience how low down you could go in horse power or in boat speed and get a result that on the whole would be as good or better than the reciprocating engine. The principal advantages of the turbine show up after you pass a figure of several hundred horse power. Take a launch of moderate speed, perhaps, a slow speed launch, say of 12 or 15 H. P. and I question whether there would be any material advantage in the turbine, except the great simplicity of it. There is nothing to break down—as Mr. Yarrow expresses it; there is a complete absence of parts, and there is nothing to get out of order. Our opinion is that that advantage is not enough to offset the disadvatnge. In large vessels it is necessary to get a propulsive economy that is as good as the present engine, because the men who have to pay the coal bills—the owners, will not listen to anything else, to anything that entails an increased expense. But it is hard to say at present of course exactly how the turbine proposition is going to work out as regards economy, I have been unable to form any idea as to the economy shown by Mr. Parsons' boats. In some cases they seem to show up an economy over the engines, while in other cases they do not seem to be as economical as the engines. Unfortunately, the practice of measuring shaft horse power has not been introduced, and we really cannot tell anything about it. There is one interesting aspect of the use of the turbines, and that is the possibility of its doing well at cruising speeds. I will put down on the blackboard the figures that we expect to get in the United States vessel, the Salem, which is a high speed scout vessel.

Mr. Wheeler: I would like to ask Mr. Curtis how about the application of the steam turbine for these short ferry trips, such as the double-end screw. I remember when I took the trip on the Revolution the turbine was handled very readily for backing or going forward, and I should think that the application would be quite successful for ferry boats.

Mr. Curtis: Mr. Wheeler, there is quite a disadvantage in this respect, that in order to be able to run in both directions and do so economically you have practically to put two turbines on every shaft. These ferry boats require large screws. They have to be stopped quickly. They want to have a large starting capacity, and a large stopping capacity, and that means that you want low revolutions, and as they are rather low speed boats anyhow, you have to have very large turbines on each shaft. Of course the reversing turbines in the case of an ordinary vessel do not require to be economical. As a matter of fact by using two sets to reverse compared with seven stages to go ahead, we get a reversing power on the same steam consumption, of about 60 or 70 per cent, of what we get going ahead, and that is all right where you are only backing or stopping—reversing momentarily for the purpose of stopping the boat; but if half the time you are running in one direction and half the time in another, it is a different proposition. I do not therefore think that the turbine offers a good solution of the ferry boat proposition.

Mr. John A. Macalpine: Mr. Chairman, I am sorry I have not had time to read Mr. Curtis's paper. There has been so much to do just recently with getting so many papers all at once. But I desire particularly to speak about Mr. Speakman's paper, which is an excellent paper, so far as it goes, but in some respects it does not go quite far enough. His first conclusion is that he has to apologize to the Society for the length of his paper. I am quite sure that the Society will at once accept his apology and that Mr. Baxter would hold the transactions open until he gets over here next month, in order that he may add about twenty pages to the paper as it stands now. In the last part of the paper one might complain of a great deal of indefiniteness, and being given hints where much fuller knowledge might have been forthcoming. Referring particularly to the first part of the paper, I would say that I think Mr. Speakman very properly writes as an enthusiast for the turbine. I say properly because I personally care very little for people who are not enthusiasts. But it is very difficult to be an enthusiast and at the same time be perfectly judicious. For instance, those who have taken a particular interest in the turbine must know that there have been considerable difficulties experienced. That cannot be otherwise—difficulties to which Mr. Speakman makes very slight, and in some cases, no reference at all. (Reading from Mr. Speakman's paper) We have for instance a comparison of the Amethyst and the Topaz—a comparison which has been very frequently referred to of late, since the particulars were originally published in *Engineering* last year, the 18th of November—which seems to show that in this particular case the reciprocating engine and the turbine give equal steam consumption with about 14 knots, which, no doubt, under the conditions of the trial, was perfectly true. Last year—early in last year, Admiral Melville and I, then in London, got from the British Admiralty the figures for the low consumption trial of the Osk—which was made long before the comparison of the Amethyst and Topaz, the Osk being run under the most favorable conditions for low consumption. They ran with one screw and one boiler. Of course, she was not using steam requiring more than one boiler at that very low power. Looking down the Amethyst's curve, I must say that she was run under the most favorable conditions possible at low speed. Looking down the curve, the consumption of the Amethyst and the Osk were equal, not at 14 knots, but at 20 knots. At 14 knots the consumption of the Amethyst was about 100 per cent—I think I am right in saying that —about 100 per cent higher than that of the Osk. The Victorian and Virginian are referred to in the paper, but I think everyone who has taken care to gather information about these two ships will not be inclined to believe that they have been an enormous success. I don't care to put it any more strongly. In the new Cunarders we have been very clearly given to understand that there is no hope—there is no forecast either of saving in weight or of saving in economy. And is it not true that these Cunarders have been increased very much in size in order to allow the turbines to be used? Is it not true further that work on the Cunarders, on the large Cunarders, is being made to go very slow until the Carmania, which should be here next month, is tried? I am only putting these as questions. I don't care to make definite statements. Early last year Admiral Melville and I went to Europe in the interest of Mr. Westinghouse to investigate the whole marine turbine question and make a report. I am sorry to say that we failed in many cases to verify as strongly as had been put forward the claims for the turbine. Some of these—some of our difficulties, I have just indicated in what I have said. We concluded that the turbine could be most successfully applied—could only be applied to fast steamers; and that there was great risk, as far as the economical results were concerned, in applying them as they then stood to steamers of much less than twenty knots speed. That prediction has, I think been very largely verified. We concluded, however, that the turbine had a very large field. The reciprocating engine however, we think, unless there is some further development than has taken place up to date, has a very much larger field. That is to say, the enormous bulk of the business is carried on in steamers a long way

below 20 knots, and as to that class of boat, as far as the turbine has been developed today, I do not think it will be a success to apply the turbine. To gain economy with the turbine we must have very high peripherical speed, which for a moderate diameter means very high revolutions. Now, for the efficiency of the propeller we must have a very moderate speed, and the two conditions only come near one another when the speed is high. Mr. Speakman has highly approved of the reticence which has been observed in the Cunard report. I am very sorry that I cannot agree with him in that decision. Here is a report which has served its purpose. It has been the result of a great deal of work by men of high position in the profession. Why should the profession—what end is served by the profession being deprived of the result of this kind of work? I think most of the gentlemen here would very highly value possessing a copy of that Cunard report. When Admiral Melville and I went to Britain we met quite a number of members of the Commission, but of course it was hardly proper for them to say anything about the report, and they did not say anything about it. We met quite a number of men who were very close to these men, and we distinctly gained the impression that the report was not an enthusiastic one; that it was more in the nature of a permission to use their names in putting in the turbine. There were some eminent naval architects that we met who were distinctly of the opinion then that the Cunard people would have played a much safer game, probably a much better game, by not using the turbine.

If the rumors that the turbine have been held back so long—the ship has been in frame for a very long time—for the trials of the Carmania, it seems to indicate that those responsible for the design are very much of the same opinion. I think that the reticence which has been observed with regard to the turbine is very unfortunate. We all admire the work which has been done by the Hon. Charles Parsons. As we said in our report, his name will go down to history as one of the great names of the profession. We all sympathize with him in his long struggle for success, and congratulate him on the great measure of success which he has achieved. It would have led to a quicker solution of his difficulties, I have no doubt, had he taken the profession into his confidence. They would not have judged him for meeting with difficulties, for all great inventions must be surrounded with great difficulties. The turbine has been a matter of consideration—rather not as it stands today, but the question of the turbine has been before the engineering profession for two thousand years; and consequently it cannot fail to be conceded that the men who have brought it to the perfection of the present day must be very great men indeed. But I say, if he had taken into his confidence the engineering profession, he no doubt would have reaped a much greater financial success than he has done, and he would have deserved all the success that he gained. Just recently I have had the pleasure of reading and criticizing a paper read by Mr. Speakman before the engineers and shipbuilders in Scotland. The paper in some respects is a good deal fuller than the paper we have in our hands. And I think it would be a very good idea if Mr. Speakman would fill up some of the gaps which, for certain reasons, he has seen fit to leave here. The details of turbine design, for instance, which he has given us, are very meagre. Of course, those who have taken an interest in the turbine—especially, in the marine turbine—have gradually come to learn—a good deal has leaked out; but there is a great deal that Mr. Speakman should add. To criticize in detail the paper would, of course, take too long; but the subjects of propulsive efficiency and propeller thrust are frequently referred to. On page 17 the effective thrust is referred to as a somewhat difficult subject, while at quite a number of places, the value of the propulsive efficiency or thrust is supposed to be known, or to be calculable with considerable accuracy for the various classes of work, when determining the proper dimensions of the propeller and turbine. To predict in a proposed design of a ship the value of the effective thrust within four or five percent, or I might say nearly this—it seems to me practically impossible; and in the design of both the propeller and the turbine much larger areas would have to be allowed for. But the question of propulsive efficiency is one to which Mr. Speakman has evidently given very extended study, and I feel sure that he could add much of interest to what is popularly known on this subject—that he could give interesting data for quite a number of ships which are running now, upon which data he has evidently based his conclusions. For instance, he has given us a propeller formula in which there is a constant C, in which C is said to lie between—in certain cases, between 24 and 30; that is for turbine ships. With ordinary reciprocating engines and slower speed the value of C is very much less. Mr. Speakman could quite easily tell us what the exact value was in quite a number of cases, and it would be a great addition to the paper if he would tabulate it. The limits of speed of the tip of the propeller are placed between 12,000 and 13,000. Of course that limit depends on the propeller. If the propeller has a course pitch at the tip the limit of speed will be very much less. With regard to the turbine I am quite sure that Mr. Speakman could very readily add much of interest. Might I suggest that he give us an appendix containing the full calculations for a particular case? It might be said that turbine calculations are of two sorts. There are exact calculations in which the use of exact steam tables and so on is required. I might say that I am speaking with some knowledge that I don't feel at liberty to divulge; but I think that Mr. Speakman is not under anything like the same restriction. If he would give us this appendix containing the complete calculation for a particular case, giving both the calculations on which one could make the preliminary determination, and the exact calculations of pressure efficiency, etc., with notes showing what is deduced from theory and what from his own experience and judgment. I think it would be very desirable. I might say that the turbine theory is very much less perfect than that of the reciprocating engine, and there is very much more in which judgment and data from particular cases counts. Perhaps asking for this calculation is asking too much, but it would compress a large amount of information into a concise and handy form. All who have had to do with turbine calculations must know that experience counts for a great deal. Mr. Speakman would render a distinct service to the profession by boldly breaking this reserve. There is much which one would like to see discussed further. For instance, it is stated in the paper that the best pressure for a given speed is a matter of opinion. I presume he means a matter of experience (reading). Then there is a great deal of data which I hardly need specify, which has to do with clearances, for the different sizes of circumferential clearances to allow for the warping of the part and roto, either the permanent warping due to the metal changing its shape after the metal has been machined—a question which has to be very carefully attended to—that is to say, in some cases the machining is done more than once. Then here are the radial clearances, and there are the longitudinal clearances, which should be as great as possible, so long as the efficiency does not suffer. Then, for instance, there is the clearance of the dumb rings, and it would be very interesting to have information which I know exists as to the percentage of loss due to the steam passing those dumb rings. I don't think I need specify any more of these questions, but I know that Mr. Speakman has quite a large experience in

turbine work, and I am quite sure that in these twenty pages, which I think Mr. Baxter would allow, he could compress a great deal of information and make his report one of the most notable papers of recent years.

President Bowles: I believe that the Society is obviously under great obligations to Mr. Speakman for placing before us his very interesting and valuable paper, and while no doubt we should all be pleased to see him add to it in many respects, it seems only fair that in the case of one, who has already been generous, to point out that in new development work there are obvious business reasons for not telling all that you know. (Applause.) Amongst others, we do not care at this particular time to have Tom, Dick and Harry designing turbine engines. (Laughter.) In view of these remarks, I shall not give utterance to the one point in which I wanted more information (Laughter); and I will only tell you that I think we will all get it without asking for it in the next three or four months (Laughter). One of the speakers has reminded me of something which it seems desirable to say, and that is in regard to the author who has read his paper here (meaning Curtis). He has one remarkable failing for an inventor, and that is, he is apt to discourage the use of his own apparatus. Now, I consider that if I had had the grip on the Curtis turbine at the time the Staten Island Ferry boats were designed that I have now, there might have been quite a different kind of service going on. It seems to me obvious that a machine consisting of a single drum on a continuous shaft and containing within itself a number of wheels that would operate that boat at full speed in either direction and with equal efficiency by simply shutting off the steam from one end and turning it into the other, has obvious advantages over a vessel containing two complete triple-expansion engines with a number of various moving parts. It has also appeared to me that the control of such an apparatus for ferry boat work has an enormous advantage. I can conceive that within an appreciably short time it is possible to control such a turbine engine from the pilot house and to place it absolutely under the control of the man at the wheel (Applause). It would no doubt be interesting to know all that Mr. Parsons knows; but it seems to me that in this turbine matter too much stress is sometimes laid on small things. The turbine has enormous advantages in practical use entirely apart from the exact economy that can be obtained at the present time. Whether the economy is 10 percent less or 10 percent greater than that of the triple expansion engine will hardly weigh with the practical advantages, of the turbine for marine propulsion. It seems hardly necessary to mention, but I believe that for merchant vessels that the very substantial gain that can be obtained in the carrying capacity of a vessel by the use of the turbine engine will far outweigh any of the questions of relative economy that are being now brought up with regard to the use of fuel. You may not see now how that is going to be brought about, and I don't propose to tell (Laughter), but it will be shown. There are a number of collateral advantages in the use of the turbine which I will only mention. Its readiness for operation is an important one in many commercial services. That has been shown, and the results have been published, in the generator turbines in use in the work at Niagara. The troubles which infest boilers from the excessive use of lubricants will be vastly reduced. I believe that the labor and the attendance upon these engines will also be very considerably reduced over what is now customary in our regular steamers. When we come to warship construction the turbine assumes even a different aspect. In securing high speed in war vessels, which now seems to be much emphasized in its importance, the question has largely resolved itself into securing the maximum supply of steam for a given weight, and now that the introduction of the turbine permits the efficient use of all the steam that can be generated, that should very much facilitate the increase in speed in larger vessels, without corresponding increase in weight. It will permit and encourage in war vessels the introduction of oil fuel as a means of producing a greater quantity of steam with the same weight of boiler. In the same way it will encourage the introduction of the mechanical stoker for the same purpose. And I believe that as the result of these three elements, that is, oil fuel, mechanical stoking, the water tube boiler and the turbine, we are about to see again a radical improvement in the types of war vessels (Applause).

Mr. W. D. Forbes: The silence which fell on this community when the Chair offered a paper for discussion, I think, judging by my own feelings, arose from the fact that we felt as if we were assisting at our own funerals. But is seems to me that these papers are read to give us some instructions—not merely to tell us where we can go and get something; and I earnestly hope that those who have had actual experience themselves will, in their further discussion tell us a little about their troubles that they have every day, and the difficulty that they encounter in handling them. Now, I earnestly beg those who will discuss it to tell us something about the trouble.

Mr. W. L. R. Emmet: My reason for asking to address this meeting is that I have had a wide experience with turbines of the type to which Mr. Curtis has referred and which are based upon his inventions. Some four or five years ago I became convinced of the practicability of this idea from certain results obtained on a very small experimental machine which had not appealed forcibly to many others who had inspected it. And upon the strength of my conviction I committed my employers to many millions of dollars of expenditure in developments based upon that idea. The carrying out of that work involved the construction of many hundreds of turbines, and we have had a great amount of experience with the practical problems involved in our case and also with the problems which relate to the turbine art generally. Our work is the application of turbines to the driving of electrical generators, and it is essentially a high speed problem; but in the course of our experiments and developments the possibilities with other speeds have also been developed to a very great extent, and furthermore, the mechanical problems and the construction possibilities have been developed to a very considerable degree, and we are, therefore, in a position to form ideas concerning what can be done. The turbine problem is one which involves a vastly greater number of variables than the problem involved in the application of steam engines to similar purposes, because turbines may be built in a great variety of ways. The problem therefore presents theoretical complications with great mechanical simplicity. The turbines should not be condemned on the basis of any—on the performance of any one turbine or upon any one man's conception of what the turbine will do. The solution of any problem with turbines should be undertaken as an individual problem, and everything should be made to conform. The Curtis turbine involves certain features which all other turbines—certain practical features which all other turbines, in my opinion, have lacked. In the first place it is a machine which operates without thrust. In the second place, it is a machine in which clearance is a matter rather of indifference than of practical limits; and in the third place, it is a machine which can be built in very light weights, even where the diameter is extremely large.

I may further say that it is a machine in which a very small number of parts can be used, as compared with the number of parts used or proposed with other types of turbines. These matters are all of very great importance, because they make possible the use of very cheap, simple and light constructions with the Curtis turbine. In our electrical work, which is high speed work, our constructions are necessarily very strong and there is great strain to be dealt with. In the marine problems these strains will not exist, and consequently a very much less expensive type of construction can be made practicable. There is another thing which may be said about the Curtis turbine, and in fact, about turbines generally, that while the calculation of the performance of a turbine is a complicated and intricate problem and one of which we can never be absolutely certain as to theoretical solution, the nature of the turbine is such, or the nature of the Curtis turbine is such, that the experimental results obtained on a small scale are an absolute criterion as to results which can be accomplished on a large scale; and this is evidenced by the experience which I will mention of the construction of 5,000 kilowatt turbines in large numbers on commercial orders on the strength of the results obtained with a two-inch diameter experiment delivering 150 horse power. In the Parsons type of turbine the thrust must be balanced, and the balancing of this thrust must involve certain loss through clearances. The amount of clearance required—the amount of clearance used, will govern the economy in a sense, and the losses will vary if the adjustment varies. With the Curtis turbine no such limitation exists, because thrust is absent, except such thrust as comes from the propeller. The Curtis turbine—its economy is independent of the clearance, in fact of the actual clearance of the buckets within such limits as we need to consider; and for this reason a test of certain buckets on a small wheel is an absolute guarantee of the performance of the same buckets or similar angle buckets on a large wheel. To illustrate the simplicity of construction of the Curtis turbine design for slow speed, I want to make a very rough sketch. (Here Mr. Emmet illustrated on the blackboard.) You have got a construction there which can be made strong and stiff with a very light weight, and its course will probably develop to be more comparable with the cost of decks and hulls than it will with the engines. This drawing would apply to a Curtis turbine of the marine type, in which a number of buckets can be used in a single shaft. Admiral Bowles has mentioned the possibility of pilot house control. I want to say that the turbine built by the General Electric Company now is controlled week in and week out from the pilot house practically, but the pilot house does not have any pilot in it. It is a distinct control from a controller operated by the speed governor, and these machines—many hundreds of them are in use and have been in use for months, and some for years, without care or attention, and they will continue so for many, many years more before any work or expense will be occasioned in connection with them. The question has been raised as to the trouble experienced with turbines. We have had in our work many troubles, many serious troubles through various kinds of miscalculations and misunderstandings. Our first wheels were steel discs, and some of them under certain conditions of casting strains would buckle. When we began we did not know what our clearances should be without effecting steam economy, and we had trouble with the wheels touching. We have since found ways of preventing the buckling of the wheels, and we have found that we can increase our clearances on large machines without affecting the steam economy. We also had trouble with our governing mechanism. Our valves stuck. All those troubles, however, have been overcome, and about the last turbines that we have are two operating in Boston, five thousand kilowatt, which have been operating there for a year, and there has never been a minute's trouble with them of a mechanical character. They are doing considerably better than the steam guarantees made upon them. But they are not as good as we can build now with our later experience, because these machines were built before we had experience with the large machines. Our present work—we are building very large turbines—we are building now six 8,000 kilowatt capacity, with a maximum output of 12,000 kilowatts, something like 17,000 H. P.—we are building six of those, and we expect to get from those—in fact, we are certain of very much better steam economies than are produced on any large engine. To properly apply the turbine is a great problem, and is a problem which will require engineering skill and daring, and if anybody thinks that he can get the product ready made and apply it to a ship without that—without having practical difficulties, why he would probably deceive himself (Applause).

Mr. D. W. Dickie: Mr. Chairman, there are one or two questions which I should like to ask Mr. Curtis. There was one brought out by the previous speaker. He mentioned that all these parts of this roto were balanced before they were put together, and that that was one of the difficulties that was very strong in the roto of the Parsons turbine. I saw one of those turbines being fitted up. And it was taken apart quite a number of times and filed and chipped in order to get the roto properly balanced so that the center of gravity was on the axis of rotation. I have forgotten the technical name, but in the Curtis turbine have you had any difficulty with the rocking moments set up by the pitch of the vessel on any boat that has been tried; that is, where the roto of the turbine in revolving pitches, there is a motion forward and a rotary motion producing a condition which turns the turbine on its base. This was very carefully figured out by Prof. Garv on the Parsons turbine on the new large Cunarders, and it was found that the points of support on the Parsons turbine are so far apart that the actual strain was unintelligible, except where the structure would have to be made strong enough to take up this strain. I think if James Watt had lived in our time or Mr. Bowles had lived in Watt's time, they would have been very fast friends, as Watt is quoted as having said that the turbine engine was the engine of the future. Then with regard to Mr. Parsons, I think he is very much like the miller and his son in Esop's fables—he is not making mistakes by taking everybody's advice. Then there is one other point that I would like to know something about, and that is the friction on the moving parts, comparing small turbines with large ones, do they follow the law of controversion of energy as the friction—the resistance of driving a shaft through the water does.

Mr. James G. Winship: I would like to ask Mr. Curtis if the turbine engine can be made of suitable size to drive auxiliaries. A large engine uses no lubrication and no oil. Now, if we could use the turbine for the auxiliaries, it would be a very good thing. If we can get the turbine to run at the right speed with small power, I think all the auxiliaries could be operated by a turbine engine. In other words, within a thousand revolutions—from 800 or 1,000 revolutions then, the auxiliaries could be operated very nicely with turbine engines. I would like Mr. Curtis to answer that question.

The Chairman: I think that has already been answered.

Mr. C. H. Crane: I have heard a great deal about the

theory of the turbine, and I am trespassing for a few moments on the time of the Society, as I happen to have some personal experience with the only turbine-driven engine which has been in general use about the harbor of New York, and it has brought to light some difficulties which I think would make it inadvisable to use such vessels for general harbor use. The vessel I refer to is the Tarantula. She has been in general service between 23d Street and Great Neck for the past two years. The troubles to which I refer are propeller troubles. The Tarantula has three propellers driven at 1400 revolutions. Those propellers were very efficient when they were new, but when they had been in for perhaps two or three weeks the edges became so badly deformed, owing to striking logs and driftwood, which is very common in the East river, that the propellers had to be removed and replaced. During the past summer I think we have used about six sets. Now that, it seems to me, for ferry boat use, would be rather disadvantageous, and I venture to say that the propeller problem which we have got to face is the greatest difficulty of the turbine.

Mr. A. J. MacLean: I was going to point out to Admiral Bowles that the turbine question for the Staten Island boats was looked into; but we found that with the high revolutions to be obtained, the same thing would happen which Mr. Crane has just mentioned. We also found that the time to manufacture would be so long, and also the cost—the vessels had to be got within a certain price; and another thing, it was an experiment, and it was not allowed.

The Chairman: Are there any other remarks, gentlemen?

Mr. Charles D. Mosher: I had some experience which might perhaps be interesting on this turbine matter. I replaced the boilers in the Tarantula after about two years' service. The boilers were opened up and we found considerable quantities of a black deposit and considerable indications of corrosion, and we began to search for the cause. We had some of this deposit analyzed, which brought to light the usual causes with one addition, that is, a considerable deposit of aluminum. The only source from which that aluminum could come is the blades of the turbine, which I understand are made of aluminum bronze. Now, the percentage of aluminum was something over 7 percent, and I would say that the water was the ordinary East river water. I have an analysis here of the deposit, which may be of interest. That would seem to indicate that there must be considerable deterioration of the blades of the turbine. As yet there has been no physical demonstration of it, but we expect during the winter to have an opportunity to examine the blades, when we may be able to present some additional information on the subject.

Mr. Curtis: I will try and answer the question of the gentleman who has asked about the balancing. The wheels of our turbine being discs in form, there is no difficulty whatever in balancing them. It is not even necessary to balance the buckets or to balance the segments before they are put on. If they are simply bolted and attached to the wheels, and the wheels, as a whole, balance—which can easily be done—we get a balance which is practically perfect for marine uses. In higher speed work, such as the General Electric Company use it for, it is necessary to get a dynamic balance in most cases, as I understand it. That is, the wheel has to be spun to let it find its own axis, and if that does not agree with the physical axis of the wheel, it is marked and the balance of the wheel is changed by adding weight to it on the other side. But practically there is no trouble in balancing, and that is a very easy matter. In regard to the side thrust on the bearings, due to the shifting of the bearings changing the direction of the axis, which takes place when a ship pitches, we have not had enough experience there to judge anything about it. I do not believe that with the small inertia that it will give any figure at all. I should say that the gyroscopic effect certainly would not more than double the side thrust on the bearings, and that would be of no consequence. Where the weight is large the revolutions are very much reduced and the rolling or pitching of the ship is comparatively low, so that in a large ship it would not be as bad as in a small ship. In regard to the deterioration of the propeller blades, brought out by Mr. Crane, our experience in the Revolution, which had somewhat smaller blades than the ordinary practice—our experience was that we did not suffer from bending or cracking. I think twice in a year and a half the tips of the blades got bent a little—some of the blades—but we had no difficulty in straightening it when it was taken out on the ways. The boat was used around New York harbor all the time, and every now and then we would strike a log. It seems as if it would do a great deal of damage, but for some reason it does not. I should imagine that it is very easy to reach a limit in the thinness of the blade.

A vote of thanks was tendered to Mr. Curtis for his excellent paper.

LAKE SUPERIOR'S GREAT STORM.

[CONTINUED FROM PAGE 29.]

with such force as to break the hatch bars and stave in the life boats. The storm was so blinding that nothing could be seen ahead of the ship's bows. When Capt. Williams discovered that he could not weather the storm, he tried to make the lee of Manitou island. At 3 o'clock in the morning a big sea stove in the cabin windows, the hatches and put out the binnacle lights. The seas were increasing in their velocity and repeatedly burst through the hatches and ran into the hold. The steel decks were beginning to break crosswise under the pounding of the storm and Capt. Williams seeing the desperate condition of the vessel, changed his course, trying to find Fox island. Shortly thereafter he brought up on South Fox island and the Vega speedily broke in two. For nine hours the crew huddled in the boat waiting for an opportunity to escape.

THE SINKING OF THE ELLWOOD.

The steamer Isaac L. Ellwood had an experience which her master, H. Cummings, will probably not care to repeat. The great steamer came near foundering in the gale which swept Lake Superior. The Ellwood left Duluth Monday afternoon for Lake Erie with a cargo of ore. She was to pick up the barge Bryn Mawr at Two Harbors, but when she arrived at that port a blinding snow storm was blowing and the lights could not be made out. The Ellwood stood off the port of Two Harbors to ride out the storm until daylight. The night was one of peril. The heavy seas assailed the ship furiously and she was buried under solid blue water almost continuously for half her length. The tarpaulings were ripped off her hatches and the hatches themselves began to give way so that the ship was taking in water. Shortly after eight o'clock it became a serious matter with the Ellwood and Capt. Cummings determined to turn about and head for Duluth. Members of the crew said that the tossing they got in the trough of the sea was something that they will never forget. She finally turned around all right and arrived at the ship canal about one o'clock. Every pound of steam had meanwhile been forced and as she approached the canal, Capt. Cummings had the engine wide open to overcome the raging current at the mouth of the canal. In spite of his effort, however, the Ellwood was thrown against the north pier, breaking some of her plates. Tugs came to her assistance and she was pulled into shallow water inside the piers where she sank.

WRECK OF THE EDINBORN AND MADEIRA.

The steel steamer Wm. Edinborn went ashore at Split Rock about 25 miles above Two Harbors and was terribly pounded on the rocks. All of her crew were saved with the exception of the mate who, when the ship struck, went upon the mizzen rigging and was not seen afterwards. The steel barge Madeira, in tow of the Edinborn, went ashore four miles below the Edinborn, and smashed herself to pieces on the rocks.

THE CORALIA AND MAIA.

The steel steamer Coralia with the barge Maia in tow went ashore at Point Isabel at Bete Grise Bay. They both went on hard, but the Coralia was subsequently released without great difficulty. The lighter Rescue, however, in endeavoring to release the Maia was driven away by weather conditions.

THE ANGELINE'S EXPERIENCE.

Great relief was felt in the office of the Cleveland Cliffs Iron Co. when the steamer Angeline was reported as having passed the Sault, after having been missing for four days. The Angeline was struck by the tempest off the Keweenaw peninsula and had a terrible battle with the storm. Once the steamer was near Eagle harbor but her master, S. A. Lyons, was fearful that he would be driven on the rocks and accordingly turned about and headed for the open sea. In this maneuvre the boat was necessarily in the trough of the sea for some time and tons upon tons of water crashed upon her decks. According to the crew there were never such seas running on Lake Superior before and the fear was that two big waves would lift her up by bow and stern and break her in two. So violent were the elements and so precarious the condition of the vessel that the crew had practically given up hope that she could weather the gale. To Wm. McLean, first mate, fell the duty of constantly watching the hatches to see that none were crushed in. With the rope fastened around his waist and two of the crew standing in the shelter of the forward cabin holding the rope, McLean time and again made the rounds on the deck. Once a wave engulfed him and he was dragged back into the cabin by his comrades. He started out again when another wave, larger than the first, picked him up and washed him overboard. He was momentarily stunned by the blow and forgot that he was at the end of the rope. He began swimming in the icy waters, but the men holding the line quickly hauled him back on deck again. Capt. Lyons was lashed to the bridge during the entire 48 hours that the Angeline was in the heart of the storm. He said that the seas ran higher that the vessel's smokestack. The Angeline is a well constructed and powerful boat and beyond the starting of a number of rivets was not especially damaged. She proceeded to the lower lakes and laid up at the C. & P. docks at Cleveland.

THE UMBRIA'S EXPERIENCE.

The steamer Umbria, of the Hawgood fleet, had a terrible time in the gale. She was stripped of her pilot house by a wave that smashed her wheel and carried away her compasses. The steamer was immediately thrown into the trough of the sea, while the crew worked to make the couplings to the after wheel. For the next 36 hours the steamer was steered thus and was badly battered and broken by the time she reached Duluth harbor. She was struck by the storm between Eagle river and Outer island and for four hours flew before it until abreast of Devil's island, when Capt. C. M. Seph gave the order to turn. It was then that she lost her pilot house. The passage of the crew from the pilot house to the after part of the boat to make the couplings was attended with great danger, as the waters were continually washing over the vessel and they were several times swept against the ropes. In 38 hours of sailing against the storm, the boat made exactly 40 miles.

FATE OF THE MONKSHAVEN.

With a hole 25 ft. in diameter in her bottom, a rock driven clear through the hull, and her stern completely into water, the Canadian steamer Monkshaven lies a wreck about one mile south of Pie island, 21 miles from Fort William. The crew of 21 men were saved. Thirteen of the men who had left the wreck in a yawl were picked up by the steamer Sylvania. When the Monkshaven struck, the crew leaped to the rock, some of them without clothing, and for 48 hours they remained without food and with only the shelter of a windbreak formed of branches of trees. The latest reports are that the vessel will probably be a total loss.

TRIP OF THE GERMAN.

About the worst beating that a boat received without losing any of her crew was that experienced by the steamer German. She left Two Harbors at 10 o'clock on Monday night and for 80 hours headed into the storm, not trying to follow a course, but simply fighting to keep safe. The waves broke over her in continuous seas and carried away all of her railings, dismantled her forward house and pilot house and broke the heavy glass windows in the cabins aft. Hot water was kept running for 36 hours, but even with this help the companion ways became so clogged with ice that it was barely possible to pass between the cabin and the rail of the boat. The wheelsman was thrown from the wheel and through the cabin door by the giant waves. It was the sad irony of fate that this steamer, having successfully weathered probably the most furious gale which there is record of on the lakes, should have become stranded on a sandbar in a snow storm when within 15 miles of Chicago.

STRANDING OF THE WESTERN STAR.

The steel steamer Western Star bound for Fort William to load grain went ashore two miles east of Fourteen Mile Point near Ontonagon, after all bearings had been lost in the struggle for hours in a terrific sea. The steamer was bound right for Fort William when she was caught in the gale and went helplessly on the sandy shores on the south side of Lake Superior. While the captain and mate were over in Ontonagon summoning assistance, the steamer Viking came along and noting the Western Star's plight, went to her assistance. A hawser was placed between the boats and in a very short time the Western Star was in deep water again. As the crew could do nothing until the master returned, the Viking went on her way. The Western Star was not seriously injured.

BURNING OF THE PARNELL.

The steamer C. S. Parnell, burned and sank off Squaw island, Lake Michigan, last week. Thanksgiving dinner was being served when smoke was discovered coming from the coal near the steering gear. The crew got two lines of hose at work, but it was found that the entire cargo was on fire and Capt. Wm. Griffin ordered the men into the life boats. They could do nothing in the heavy sea and were nearly exhausted when picked up several hours later by the steamer Harlem. The Parnell was built in 1884 and was owned by M. J. Cummings of Oswego, N. Y. The Parnell was worth about $40,000 and was insured for $30,000.

The steel steamer Harold F. Nye had a frightful experience in the storm. Her cargo shifted and the steamer Colonel lay alongside for two hours off Isle Royale to render assistance if needed. Wm. Sturtevant, the mate, was washed overboard and drowned. When the Nye left port she was drawing 17 ft., but when she succeeded in making Two Harbors she was drawing 20 ft. and narrowly escaped foundering.

ARBECAM'S COMPASS.

A meeting was held Nov. 14 in the offices of Capt. Huntington, 150 State street, Boston, to make tests of the accuracy and the merits of Arbecam's alidade deviation correcter, position, distance and deviation finder, the new instrument which is being placed upon the market this winter. Among those present were Capts. Coleman, Clark, Huntington, Lavender, Arbecam, and Cookum, beside several local compass adjusters and others. The tests with the instruments all acknowledge to be eminently successful. It was possible instantly to correct any deviation of the compass and in an incredibly short time tell if there was any deviation to correct. The compass was next adjusted with the instrument and then Capt. Huntington practically destroyed the compass and demonstrated his ability to run his ship entirely without the aid of a compass at all, relying solely upon the newly patented appliance to take its place. He was entirely successful in every demonstration that he made.

Only one instrument was mentioned as being at all in the same class as the Arbecam instrument and finally its advocate admitted that it was not a compass deviation correcter and could not be used in places where the Arbecam's instrument was suitable to do the work. The instrument mentioned was of English make. In order to make the Arbecam instrument adapted to the great lakes, they decided to make the deviation corrector extend up to 30 degrees instead of 15 degrees as at present, as frequently where there is a large load of ore on a vessel the deviation will amount to more than 15 degrees. The instrument is further going to be placed in a box without being taken apart, in this way the instrument can be set up ready to use in less than half a minute. The box is 7½ in. x 3½ in. x 6½ in., and with the instrument complete does not weigh over 10 lb. The triangulation plate is to be made in accordance with the English compass extending from zero to 180 degrees on a side instead of running from zero to 360 degrees. All present decided that the instrument was, in its present shape, adapted to the best interest of all navigators, and that it was a perfect instrument for the uses intended. Full explanations of the instrument and its uses in the form of a booklet can be had by applying to B. V. How, 106 Tremont street, Boston, Mass.

ERIE'S CHICAGO LIMITED.

New York, Dec. 6.—The Chicago Limited over the Erie Railroad now leaves Jersey City every day a completely and throughly sterilized train. A device has been perfected by Chemist Landon of the mechanical department by which all the cars on this vestibuled train are thoroughly sterilized at Jersey City after each round trip between Jersey City and Chicago, a run of about two thousand miles. The daily routine of sterilization began on Wednesday of this week. Experiments looking to this method of so cleaning cars as to kill all disease germs and destroy all bad odors, have been in progress nearly a month. The Pullman Company has investigated the method and has given its consent that all bedding, clothing and hangings in their cars used on these trains, be submitted to the sterilizing process, as they are satisfied it kills all disease germs, injures nothing in the cars and makes traveling in such sterilized cars absolutely safe in preventing disease infection.

The process devised by Mr. Landon, consists of the mixing of two chemicals so that a sort of formaldehyde gas bath is given to each car, which is tightly closed for the purpose at the end of each trip. After the gas has been permitted to do its work, the cars are thoroughly aired, swept, washed and later on dusted, so that each car leaves the station guaranteed to be absolutely free from germs of la grippe, tuberculosis, fever or other contagious diseases, that any passenger may have left behind him.

This sterilizing process will be used for the present on trains No. 3 and No. 4, and as soon as arrangements can be perfected, will be extended to other through trains on the line.

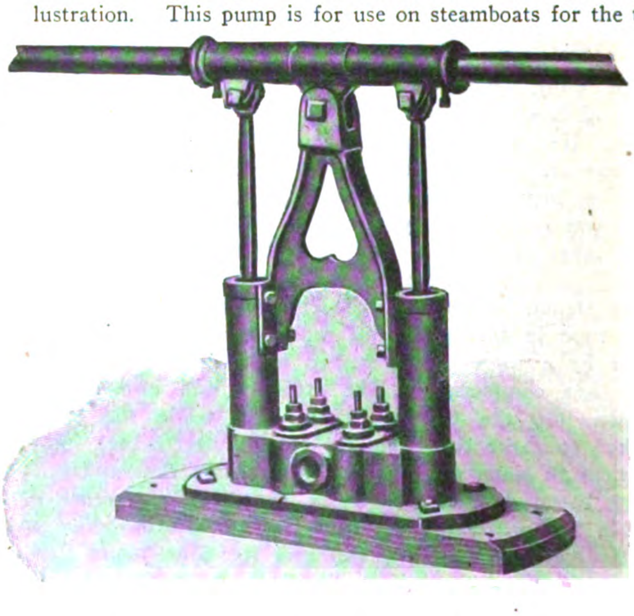
A deodorizing apparatus has also been devised, that for the past two weeks has been in use in fifteen Erie club, parlor and commuter's cars. This apparatus is placed under the seats in the cars, out of sight of passengers, and gives off an odorless gas, which combines with the stale tobacco smoke, or other offensive odors which may accummulate in the cars, and serves to completely nullify them. This treatment has been so effective that it will be extended to all the passenger cars in the Erie service. It is an entirely new process and one that has never before been attempted in railway service. The chemicals used give off no perceptible odor, so that after a night's treatment, the air in the cars is as fresh and cleanly as that out of doors, a fact which has been noted and commented on by some Erie passengers within the past week or two while experiments have been in progress.

NEW REVOLVING CLAM-SHELL DREDGE.

The Dunbar & Sullivan Dredging Co., Buffalo, N. Y. have about completed a new revolving clam-shell dredge which will be ready for operation next spring, and which it is understood is far superior to the ordinary dredge. The new clam-shell dredge will be capable of excavating 60 ft. back from the face of the dock into the scow or vice versa. It will excavate at either end of itself and dump into scow at the other end. This makes possible through cutting and cleaning narrow strips cheaply. It will excavate trenches of 150 ft. or more in depth. It will excavate material and throw it to one side 150 ft. from the orginal site where there is 4 ft. of water between dump and channel. It will excavate shallow channels down to 4 ft. by 44 ft. It will clean out bowlders or obstructions without disturbing the surrounding bottom. It will excavate close to docks without injury to the dock. It will do anything that an ordinary derrick will do up to ten tons at 75 ft. radius, and it can therefore be seen that it makes an excellent wrecking tool.

A HAND TESTING PUMP.

The Dake Engine Co., Grand Haven, Mich., manufacture a hand testing pump which is shown in the accompanying illustration. This pump is for use on steamboats for the test-



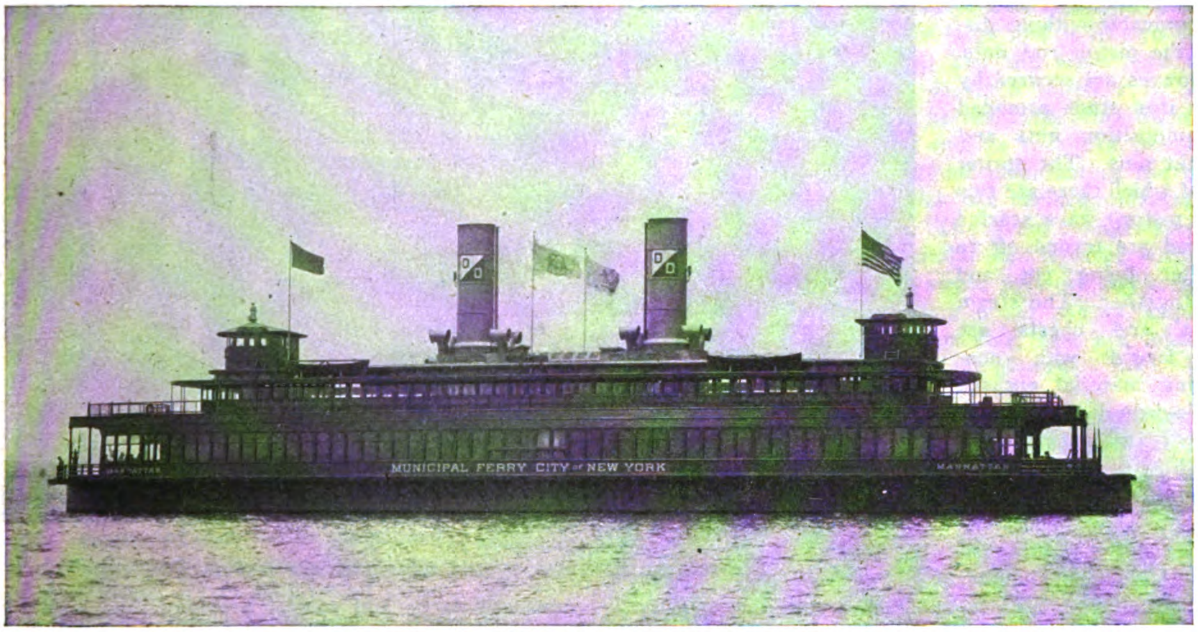
ing of boilers. It is simple, durable and efficient. The maker states that many orders are being received for it, and that the users express perfect satisfaction with it.

NEW YORK CITY'S NEW FERRY SYSTEM.

The inauguration of New York city's new municipal ferry system and its installation between the boroughs of Manhattan and Richmond on Oct. 25, attracted great attention and evoked the praise and admiration of all; owing to the magnitude of the enterprise, and the exceptional and superior features embodied in the new ferryboats. When the idea of rapid transit to Staten island was conceived and favorably determined upon, the New York dock department called on Prof. Alex. J. Maclean, of Millard & Maclean, naval architects, to prepare the necessary designs and specifications, and how well the exacting conditions imposed have been met, and all the requirements fulfilled, is shown in these splendid boats fully equipped with all the modern conveniences, and superior to all others for like service. The city is now running this ferry successfully, with the five boats: Manhattan, Bronx, Brooklyn, Queens and Richmond, named after the five boroughs of Greater New York. They are running on a regular schedule of fifteen minute intervals during the busy hours of the morning and evening, and on a half-hour schedule the remainder of the day and night. The boats are exceptionally large and commodious, being 250 ft. long and 66 ft. in width over guards and with a draught of 12 ft. They are the finest and fastest ferryboats in New York harbor. In a trial trip on the Chesapeake bay the Manhattan made a speed of nearly 19 knots per hour against the tides, and every one of these five boats has made equally fast time when they were tried out.

It was first intended that all the boats should be constructed at Sparrows Point, Md., but later the Maryland Steel Co. sublet the construction of the boat Richmond to the Burlee Dry Dock Co. at Port Richmond, S. I. These boats are identical in design and construction, with steel hulls and wooden superstructures, each having six water-tight bulk-heads, which make them practically unsinkable. One distinctive feature of these boats, noticeable to the traveling public, is found in the exceptional comfort to passengers. The interior of the cabins is fitted in mahogany, and all the seats are of the same material with ample space and arm rests. The upper cabins are of ample size, being spacious, well lighted, and the plate glass windows are so arranged as to give an unobstructed view in all directions. Cross seats are also provided. Rubber tiling is used in the covering of the upper saloons, the lower saloons being covered with linoleum. Ample toilet arrangements are provided replete with the most modern conveniences; reliable and complete equipments of life-saving appliances are also installed.

These boats are propelled by twin steel screws, driven by two inverted direct-acting two cylinder compound engines, having crank shafts bolted together, and with steam cylinders 22½-in. and 50-in. diameters by 30-in. stroke, and develop over 4,100 h. p. at 157 revolutions per minute. Two boiler rooms are provided, one at each end of the engine room in which are placed Bacock and Wilcox water tube boilers, fitted with blowers for forced draft, of the closed stoke-hold system. The design and construction of the pumping machinery and use of steam pumps on these boats, are so exceptional as to deserve special mention, and in the equipment for each boat are the following pumps, designed and built by A. S. Cameron Steam Pump Works, of New York city:



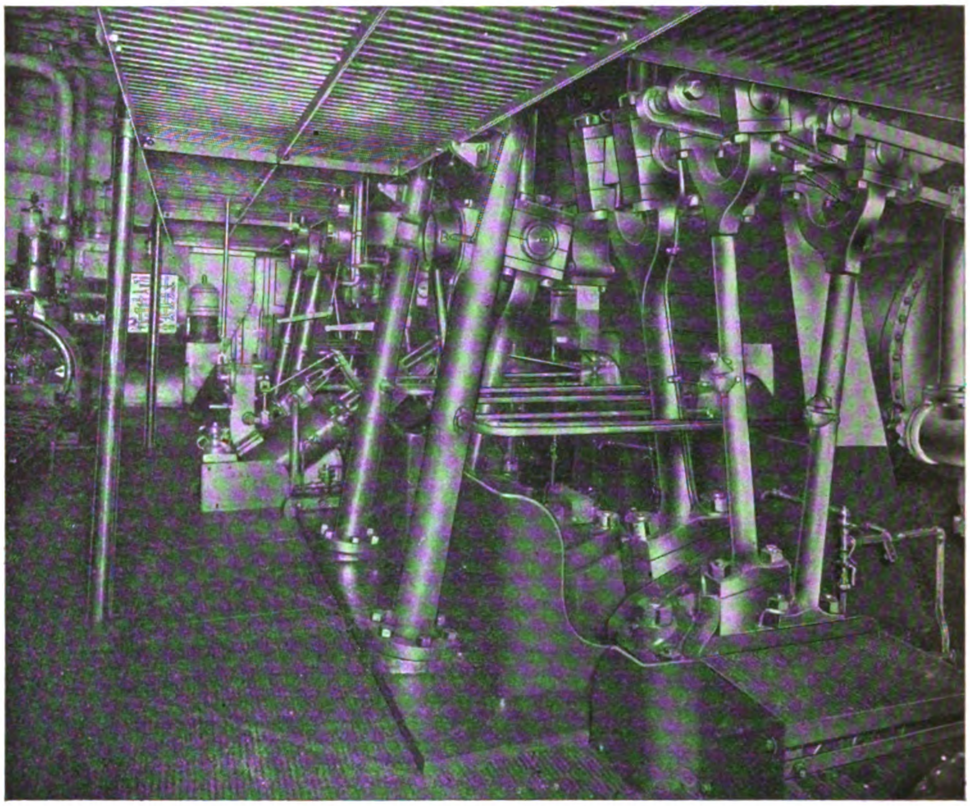
NEW YORK CITY'S MUNICIPAL FERRY BOAT MANHATTAN.

One 10 x 22 x 18 vertical twin beam air pump; two 10 x 6 x 13 vertical marine piston boiler feed pump; one 12 x 8 x 16 vertical marine piston boiler feed pump; one 6 x 8 x 8 vertical marine piston sanitary pump; one 5 x 4 x 7 horizontal piston fresh water pump; one 6 x 10 x 12 combined air pump and jet condenser.

The vertical twin beam air pumps are used to pump the condensed exhaust steam from the main condensers and deliver it to the feed water tank or overboard; being of ample size, with 10-in. steam cylinder, 22-in. air cylinder, 18-in. stroke.

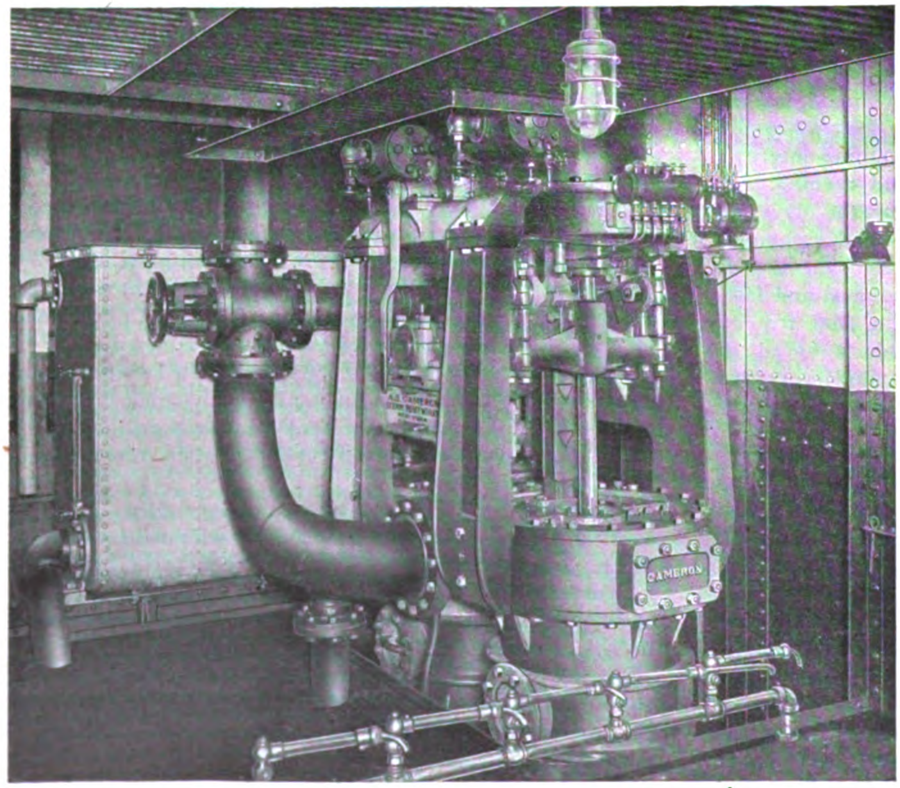
The steam end consists of two independent Cameron vertical steam cylinders, designed to withstand the high steam pressure and temperature common to marine work and having their steam chest plungers connected together, thus insuring absolute certainty of harmonious action under all conditions. At the same time, should it be desired for any reason to run either steam cylinder alone, the other may be disconnected in a very few minutes and the whole pump driven by one steam cylinder. The cylinders are connected by piping and provided with suitable valves for running either side independently, and are mounted on a suitable cast iron plate in such a manner as

to allow the lower covers to be removed, which permits the removal of the steam piston and the rod from the lower end of the steam cylinder, a noteworthy feature where the head room is limited. The steam piston rod stuffing boxes are fitted with metallic packing. The steam pistons are secured to their rods by a taper fit, bronze nut and split pin and have removable followers, spring and bull rings; these parts being removable without disturbing the piston rod nuts. The followers are secured by wrought iron studs provided with composition nuts and brass split pins. The spring rings (of which there are two in each piston) have scarfed joints and are turned off to size after being cut and sprung together. The steam cylinders and chests are heavily lagged with non-conducting material encased in Russia iron jackets.



OPERATING PLATFORM, ENGINE ROOM, STEAMER MANHATTAN.

The vacuum end is made of four iron parts—a suction chamber, a discharge chamber and two pump barrels, the latter lined with composition. Both suction chamber and discharge chamber are substantial castings, heavily ribbed and so constructed as to permit of free and easy flow of water at every point, and special attention has been given to the entire elimination of air pockets. The foot and head valves are on removable composition valve plates and the valves are the "Kinghorn" type consisting of thin brass discs. The areas through the valve seats are unusually large and special provision has been made to prevent any of the parts from unscrewing or becoming loose. The pump pistons are of composition and contain bucket valves and are fitted with "Tucks" packing. The vacuum piston rods are of Tobin bronze, and are attached to the piston by taper fit and nut and split pin. The vacuum cylinder stuffing boxes are of ample depth and fitted with soft packing and both the cylinder head and the gland provided with removable bronze thimbles. Ample hand holes are provided in the working barrels and chambers for inspection or repair of the valves.



VERTICAL TWIN BEAM AIR PUMP, STEAMER MANHATTAN.

The steam cylinders rest on a substantial plate supported by two heavy, rigid cast H frames, the horizontal bars of which support the bearings for the rocker shaft and, at the same time, thoroughly stiffen the pump longitudinally. The rocker shaft is of steel and works in large adjustable bearings. The beams are of steel and amply strong to drive both pump pistons when one steam cylinder is disconnected. The links are of the standard marine type, consisting of steel rods and solid bronze ends working on steel pins of large bearing areas. The cross head is a steel casting, the piston rod being secured in it by taper fit and taper key (which are held by set screws). This allows a quick and easy disconnection of either side of the pump from its steam cylinder. To prevent the side

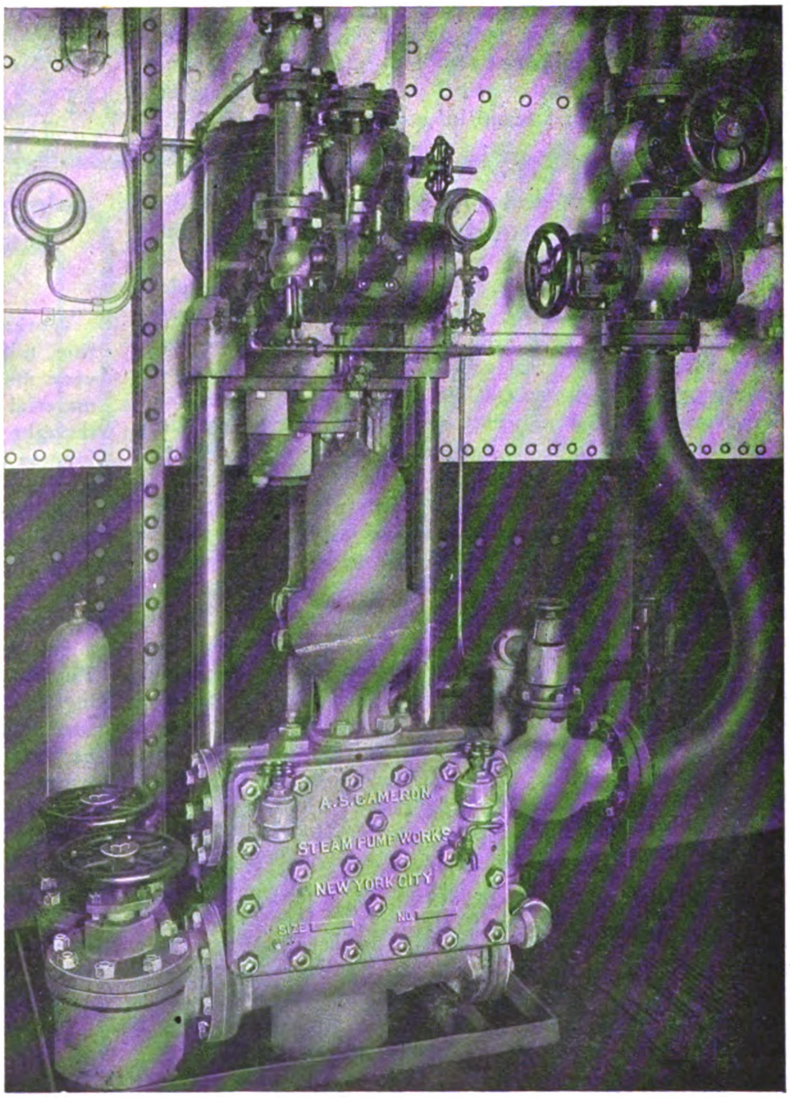
thrusts of the links from coming on the piston rods and wearing out the stuffing boxes, the cross head is provided with adjustable bronze shoes which bear on a heavy guide bar, taking up all the side thrust.

To permit constant running, a continuous oiling system is provided consisting of stationary sight feed oil cups with separate pipes leading to all working parts. Drain cocks are located at all necessary points, affording quick and easy drainage; suitable provision is made for holding up the vacuum cylinder covers, pistons and followers when packing the pump. All parts requiring to be removed or handled are provided with forcing screws and lifting bolts.

The boilers are fed by Cameron vertical boiler feed pumps of the marine piston type. The main feed pumps, size 12 x 8 x 16, are installed in the engine room. There are also two auxiliary feed pumps, one in each boiler room, of the same type but of the size 10 x 6 x 13. The sanitary pumps, size 6 x 8 x 8, are of the Cameron vertical marine type, having entire bronze water cylinders, and are used for delivering sea water into a 100-gallon pressure tank, in which a constant water pressure of 20 lb. is maintained. The fresh water pump, size 5 x 4 x 7, is of the Cameron regular horizontal piston pattern, and supplies the drinking fountain coolers and toilet rooms, maintaining an even water pressure of 20 lbs. There is also installed in the engine room of each boat a 6 x 10 x 12 Cameron combined air pump and jet condenser. The steam ends of all of these vertical marine pumps are of the standard vertical Cameron type designed to withstand the high steam pressures and temperatures, common to marine work. The steam mechanism consists of four stout pieces only, none of them exposed to injury. The plunger is reversed by means of two plain tappet valves, and it is the only inside valve gear that is absolutely reliable. The steam cylinders and chests are lagged with non-conducting material, securely encased in sheet iron jackets.

The water cylinders are fitted with removable composition bushings which may be readily and quickly removed or replaced without dismounting the pumps or disturbing the piping. The water valve chest is cast in one piece with the cylinder, reducing the number of gaskets to the minimum, and special provision is made against air pockets. The pump valves are of the Cameron type, the seats being driven in on a taper and one valve stem passing through both the suction and discharge valve, valve seats, springs and spring holders, making it impossible for any part to become loose or disarranged; yet by the removal of this stem all these parts may be taken out. The lift of the valves is limited by a positive stop. One bonnet covers the entire front of the chest and when removed exposes its whole interior and gives access to every part of it. The area through the valves and passages is made very large to allow the pumps to run at a high speed, but the number of valves has been kept as few as possible to reduce the liability of breakage and to facilitate replacing them as quickly as possible. A large air chamber is placed directly over the valve chest where it is most efficient and available, by not taking up any floor space and not interfering with the piping. The steam and water ends are connected rigidly by four heavy steel rods secured directly to the cylinders by means of substantial lugs, thus allowing the cylinder heads to be removed or replaced without dismantling the pump.

The steam piston is secured to the rod by a taper fit and a bronze nut and split pin, and has removable follower, spring and bull rings; these parts being removable without disturbing the piston rod nut. The follower is secured by wrought iron studs, provided with brass nuts and brass split pins. The spring rings, (of which there are two) have scarf joints, and are turned off to size after being cut out and sprung together. The water piston and follower are of composition, secured to the rod by screwing home against a shoulder and with a jam bronze nut and split pin. The piston may be packed from the upper end of the water cylinder. The ring follower is secured by Tobin brass studs, nuts and split pins. The piston rod is made amply large and is in two parts, the steam end being of steel and the water end being of Tobin bronze; they are fastened together by screwing into a clamp nut made in halves, facilitating disconnecting the rods. Either piston and its rods can be taken out between the tie rods without dismounting the pump or disturbing the piping, which is a decided advantage where the head room is limited. The steam cylinder stuffing box is bushed with bronze thimble and is fitted with metallic packing suitable for high steam pressure and temperature. The water cylinder stuffing boxes are of ample depth and are fitted with soft packing, and are bushed with bronze thimbles, as are also the glands.



MAIN FEED PUMP, STEAMER MANHATTAN.

In all of these pumps the pipe openings are flanged, and the drain cocks are fitted to all joints requiring drainage, in both cylinders and chests. All parts that have to be removed are provided with forcing screws and lifting bolts, and suitable provision is made for holding up the pistons, rod and water cylinder cover, when packing the water piston. Sight feed lubricators and complete sets of wrenches are provided for all these pumps, and every detail has apparently been worked out with great care and exactitude, and in the aggregate they represent a complete and perfect pumping equipment.

SUPPLIES FOR NAVY YARDS.

Washington, Nov. 25.—Heavy awards of contracts for supplies and equipment for both eastern and western navy yards will be made in the near future by the bureau of supplies and accounts of the navy department. Among the supplies for the Portsmouth, N. H. navy yard for which bids will be opened on Nov. 21 are 18 dozen taper-shank twist drills, Morse taper of various sizes, 28 dozen straight shank twist drills of assorted sizes; 80 dozen steel wire gauge drills of various sizes; one friction-driven lathe center grinder; and half a dozen milling cutters for grooving taps and reamers.

For the Portsmouth yard also there is a call for six self-dumping and self righting coal buckets of 1,120 lb capacity each to be constructed of open-hearth steel of an ultimate strength of at least 55,000 lb.

For the Washington, D. C. navy yard proposals will be received until Nov. 21 for 25,000 lb of 8 in. round machine steel of a tensile strength of 60,000 lb.; 1,089 lb. of 1⅝-in. nickel steel and 4,068 lb. of nickel steel forgings—all nickel steel to be of a tensile strength of 90,000 lb per square inch.

For the Boston, Mass. navy yard one 14-in. chucking outfit for 3 x 36 Jones & Lamson flat turret lathe, as made by the Jones & Lamson Machine Co. of Springfield, Vt. Also one rivet forge, portable and not to exceed 37 in. in height over all.

Other items for the Portsmouth, N. H. navy yard include one valve-reseating machine complete with disk cutters and all tools, a complete equipment of milling machine tools for Brainard-Becker's universal milling machine No. 14½; 12 tube scrapers for Niclausse boiler tubes.

On Nov. 21, also bids will be opened for furnishing for use at the Mare Island navy yard, Cal. one double cylinder, double friction drum hoisting engine, complete with boiler and all accessories and four independent winch heads; one motor and all necessary attachments for converting a 32-in. Lodge & Shipley lathe to direct motor drive; two self-feeding ripsaw tables, motor driven; one No. 2 die-sinking machine as made by the Pratt & Whitney Co., Hartford, Conn.; one surface-grinding machine, suitable for surfacing work at least 50 in. long, 14 in. wide and 11½ in. high, complete with countershaft, tight and loose pulleys and all accessories.

On Nov. 28, 1905 bids will be opened for additional equipment for the Mare Island, California yard including one 14-in. sand belt machine, motor driven; one 21-in. upright Cincinnati drill with back gears, motor driven, and one oil-burning apparatus to be used in connection with a marine horizontal return-fire tubular Scotch boiler (single end) 12 ft. 6 in. in diameter by 11 ft. long, installed aboard the U. S. tug Unadilla.

On December 5 bids will be opened for furnishing for the Boston navy yard one open-side extension planer to plane at least 84 in. wide by 60 in. high by 16 ft. long; for the New York navy yard, two pneumatic drills, size A, six pneumatic drills, size E and four pneumatic drills, size G; one portable electric internal grinder; one portable radial drill; one portable electric hand or breast drill; one portable electric grinder for lathe attachment; one cold metal sawing machine to carry 18-in. blade; 1 cold metal sawing machine to have 15-in. blade; one cold metal sawing machine to have 13½-in. saw blade; for the League Island, Pa., navy yard one scroll-saw machine with tilting table; one 2,500-lb single frame steam hammer; one 150-lb. power hammer; one 100-lb. power hammer; one 50-lb. power hammer; and one centering machine, complete; for the Norfolk, Virginia navy yard one screw-cutting extension gap lathe; and one 18-in. universal milling machine; for the Pensacola, Florida navy yard, one twist drill emery grinding machine; one engine and screw-cutting lathe complete; one single spindle edge molding machine with reversing friction and countershaft; one improved pipe cutting and threading machine complete with necessary dies to cut off and thread pipe from 1¼ to 6 in. inclusive; and one 15-in. pillar shaper; for the New York navy yard, one motor driven 42 in. by 24 in. double wheel band-sawing machine complete and one log jack or canter with drum for wire rope complete; for the Norfolk navy yard, one pattern and core-box machine, and for the Pensacola navy yard, one band saw, electric driven, with resawing attachment to resaw material up to 22 in. wide and 6 in. thick with duplex reversible table for both resawing and regular curve band sawing; one heavy automatic cut-off saw, electric driven; and one heavy self-feed ripsaw machine, electric driven.

Among the bids opened this week by the bureau of Supplies and Accounts, navy department were a number covering shell reamers and twist drills. The bidders on these items follow together with their proposals on Class 101,—perhaps the most important in the schedule:

Manhattan Supply Co., New York City,	$2,496.57
Baird Machinery Co., Pittsburg, Pa.,	2,068.75
Coggins & Owens, Baltimore, Md.	2,091.98
The Fairbanks Co., New York City,	2,125.59
J. H. Leonard, New York City,	2,146.08
Montgomery & Co., New York City,	2,022.02
C. S. Mersick & Co., New Haven, Conn.,	2,127.53
Philadelphia General Supply Co.,	2,146.08
Rudolph & West Co., Washington, D. C.,	2,097.25

HIGH PRESSURE PACKING.

Working under high pressure is such a modern condition, not only in one's personal business life, but in the very machines which make possible the manufacture of material which but a few short years ago was not even thought of, that it is no exaggeration to say that a fortune awaits the packing manufacturer who can furnish a thoroughly dependable high pressure hydraulic packing, something that will stand under the enormous strains now being encountered as frequently as the hitherto common pressure. In fact, the "up to date" equipped plant, has no use for a low pressure machine. To the mechanical superintendent, therefore, who has been at his wits' end for a successful hydraulic packing, the D. S. Paterson Co., of Philadelphia, will be pleased to lend the aid of their packing superintendent, who is himself a practical engineer, for the solving of all troublesome questions which cannot be satisfactorily handled with their regular high pressure hydraulic packing, style No. 3.

This high pressure hydraulic packing is used in connection with their high pressure sheet, style No. 106, which is a combination of superior rubber, with an insertion of high grade asbestos and brass wire. The invariable satisfaction with which it is being received is sufficient to guarantee that it is simply a case of knowing what to use and where to get it.

Fifteen scows, ranging from 70 ft. to 124 ft. in length, will be built at the Supple shipyard at Portland, Ore. for the Northern Pacific Railway Co. The largest scow will be 124 ft. long and 32 ft. wide. Eight of them will be 92 ft. long and 26 ft. beam.

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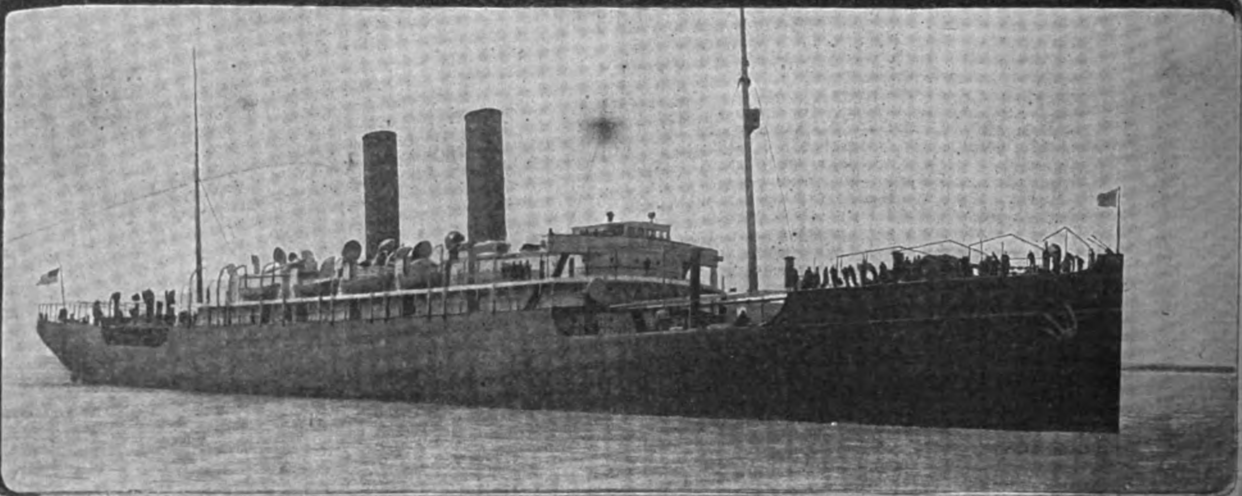

New York Shipbuilding Company

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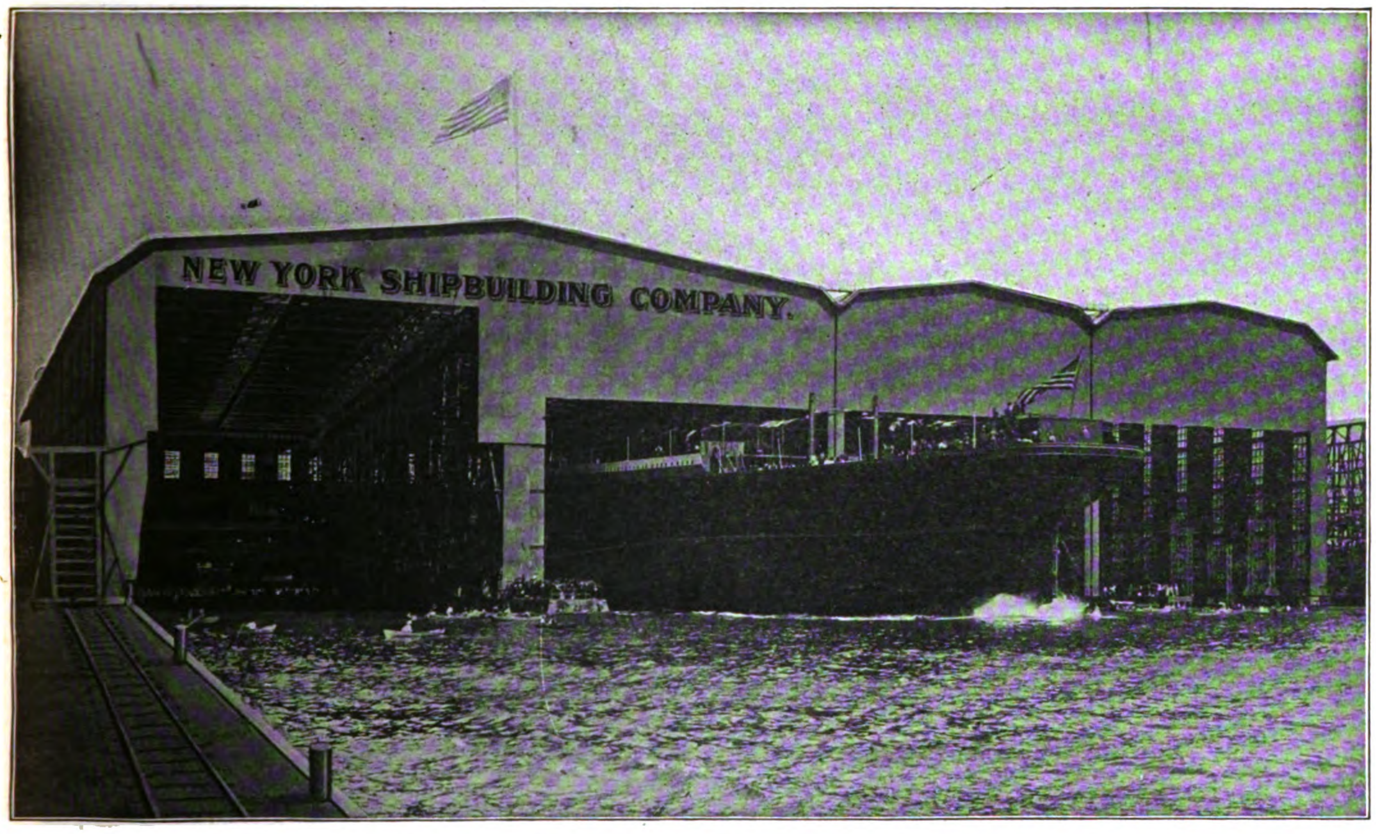
SHIPS — ENGINES — BOILERS
HEAVY MACHINERY



Launch of "Mongolia," Pacific Mail S. S. Co., July 25, 1903.
615 feet long, 65 feet beam, 51 feet deep.

Best Facilities for Repair Work

**Pneumatic and Electric Tools;
ample wharfage accomodation.**

100 ton crane.

Repairs done under shelter.


CLYDE LINE APACHE
U.S. BATTLESHIP MAINE
THE
WM.
CRAMP
& SONS
SHIP & ENGINE BUILDING Co.
ESTABLISHED 1830
I.P. MORRIS COMPANY
(ESTABLISHED 1829)
KENSINGTON SHIPYARD Co
WARSHIPS AND MERCHANT STEAMERS
Pumping, Blowing and Hoisting Engines, Dry Docks
Vertical and Horizontal Turbines
Centrifugal Pumping Machinery
Marine Railway.
Repairs to all classes of vessels
LARGE TURBINE
VIEW OF ONE OF OUR DRY DOCKS
Philadephia

The Shipowners Dry Dock Co.

CHICAGO, ILL.

Building and Repairing of Steel and Wooden Ships

Yard and Dry Docks: Halsted St. and North Branch

Largest Dry Dock: 480 ft. on keel blocks

OFFICE, 381 NO. HALSTED ST. PHONE, NORTH 1658

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SAFETY WATER-TUBE

BOILER CO.

Manufacturers of High Grade

Marine Water Tube Boilers

Generators of the Highest Quality of Steam

NEARLY 1500 IN USE

Send for circulars and stock sheet

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Phone 599 Cortlandt

Works: Red Bank, N. J.
Phone, 49 Red Bank

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LUNKENHEIMER GREASE CUPS

WILL PROLONG THE LIFE OF BEARINGS AND PREVENT THEM FROM GETTING HOT.

MADE IN GREAT VARIETY WITH AND WITHOUT AUTOMATIC FEED. STRONG, PRACTICAL AND DURABLE.

IF YOUR LOCAL DEALER CANNOT FURNISH THEM, NOTIFY US.

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Largest Manufacturers of Engineering Specialties in the world.

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BRANCHES

NEW YORK—26 Cortlandt St.

LONDON, S. E.—35 Great Dover St.

We also manufacture a complete line of Iron and Brass Valves, Whistles, Cocks, Injectors, Oil and Grease Cups, Water Columns, Mechanical and Hydrostatic Lubricators, Etc.

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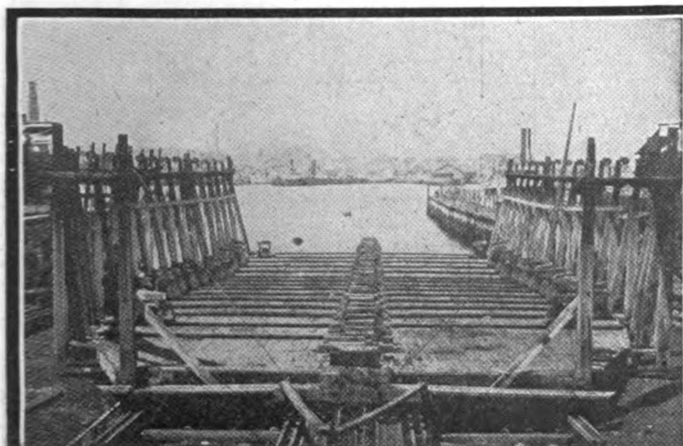

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RAILWAY DRY DOCKS

TIMBER OR STEEL CONSTRUCTION

Safe—Convenient—Rapid.

H. I. Crandall & Son Co.

Engineers and Contractors

East Boston, Mass., U. S. A.

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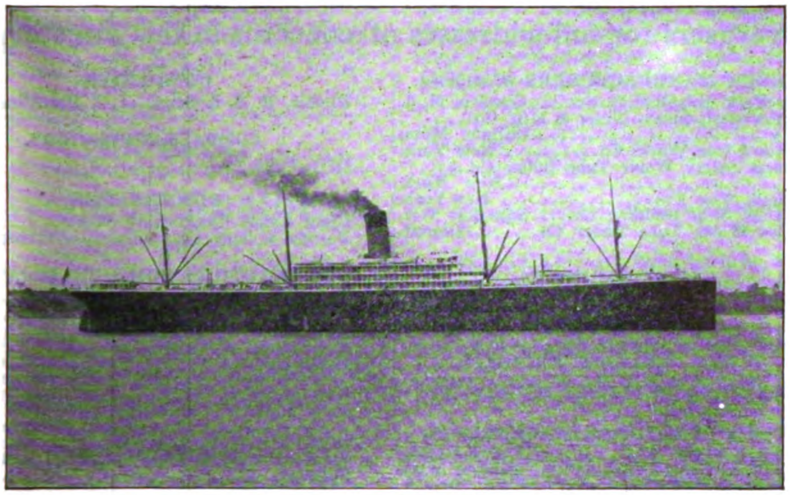

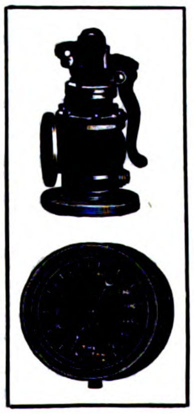

Buyers' Directory of the Marine Trade

For a more complete classification than that represented by advertisers in the Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, marine and naval directory of the United States, published by The Marine Review, Cleveland.

See accompanying index of Advertisers for full addresses of concerns in this directory.

AIR COMPRESSORS, AIR HOISTS, ETC.
Great Lakes Engineering Works......Detroit.
Mietz, Aug. ....New York.

AIR PORTS, DEAD LIGHTS, ETC.
Marine Mfg. & Supply Co.........New York.

AIR PUMPS AND APPLIANCES.
Fore River Ship & Engine Co..Quincy, Mass.
Great Lakes Engineering Works......Detroit.

ANCHORS.
Bowers, L. M. & Co.......Binghamton, N. Y.

ANTI-FRICTION METALS.
Cramp, Wm. & Sons...........Philadelphia.

ARTIFICIAL DRAFT FOR BOILERS.
American Ship Building Co.........Cleveland.
Detroit Ship Building Co............Detroit
Great Lakes Engineering Works......Detroit
Sturtevant, B. F., Co.......Hyde Park, Mass.

ASH EJECTORS.
Great Lakes Engineering Works......Detroit.

ATTORNEYS AND PROCTORS IN ADMIRALTY.
Gilchrist, Albert J................Cleveland.
Goulder, Holding & Masten........Cleveland.
Hoyt, Dustin & Kelley............Cleveland.
Jenkins, Russell & Eichelberger.....Cleveland.
Kremer, C. E........................Chicago.
MacDonald, Ray G..................Chicago.
Shaw, Warren, Cady & Oakes........Detroit.
White, Johnson, McCaslin & Cannon Cleveland

BAROMETERS, MARINE GLASSES, ETC.
Ritchie, E. S. & Sons.......Brookline, Mass.

BLOCKS, SHEAVES, ETC.
Boston & Lockport Block Co.....Boston, Mass.
Cleveland Block Co................Cleveland.

BLOWERS.
Power Specialty Co..................Detroit.
Sturtevant, B. F. Co.......Hyde Park, Mass.

BOAT BUILDERS.
Drein, Thos. & Son..........Wilmington, Del.
Kahnweiler's Sons, David.........New York.
Lane & DeGroot....Long Island City, N. Y.
Marine Construction & D. D. Co..........
..........Mariner's Harbor, S. I., N. Y.
Truscott Boat Mfg. Co.....St. Joseph, Mich.
Willard, Chas. P. & Co. Winthrop Harbor, Ill.

BOILER CLEANING DEVICE.
Power Specialty Co..................Detroit.

BOILER COMPOUNDS.
The Bird-Archer Co ....New York
Dearborn Drug & Chemical Works....Chicago.

BOILER MANUFACTURERS.
Almy Water Tube Boiler Co..Providence, R. I.
American Ship Building Co............Cleveland.
Atlantic Works..........East Boston, Mass.
Chicago Ship Building Co...........Chicago.
Cramp, Wm. & Sons...........Philadelphia.
Dearing Water Tube Boiler Co........Detroit.
Detroit Ship Building Co............Detroit.
East End Boiler Works.............Detroit.
Fletcher, W. A. & Co.........Hoboken, N. J.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works......Detroit.
Kingsford Foundry & Machine Works....
..........................Oswego, N. Y.
Marine Iron Works.................Chicago.
Maryland Steel Co.......Sparrows Point, Md.
Milwaukee Dry Dock Co..........Milwaukee.
Mosher Water Tube Boiler Co....New York.
Newport News Ship Building Co.........
....................Newport News, Va.

BOILER MANUFACTURERS—Continued.
New York Shipbuilding Co.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co....
..........................Duluth, Minn.
Quintard Iron Works Co...........New York.
Roberts Safety Water Tube Boiler Co....
.............................New York.
Stirling, The Co.................New York.
Superior Ship Building Co.....Superior, Wis.
Taylor Water Tube Boiler Co........Detroit.

BOILER RIVETS.
Bourne-Fuller Co.................Cleveland.

BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co..Cuyahoga Falls, O.

BRASS AND BRONZE CASTINGS.
Cramp, Wm. & Sons............Philadelphia.
Fore River Ship & Engine Co..Quincy, Mass.
Great Lakes Engineering Works......Detroit.
Lunkenheimer Co..................Cincinnati.
Macbeth Iron Co..................Cleveland.

BRIDGES, BUILDERS OF.
Cowing, John P...................Cleveland.
Scherzer Rolling Lift Bridge Co.....Chicago.

BUCKETS, ORE AND COAL.
Brown Hoisting & Conveying Machine Co.
.... Cleveland.

BULKHEAD DOORS, WATERTIGHT.
"Long Arm" System Co..........Cleveland.

CABIN AND CABINET FINISHING WOODS.
Martin-Barriss Co.................Cleveland.

CANVAS SPECIALTIES.
Baker & Co., H. H...................Buffalo.
Bunker, E. A. ....New York.
Upson-Walton Co..................Cleveland.

CAPSTANS.
American Ship Windlass Co..Providence, R. I.
Hyde Windlass Co.................Bath, Me.
Marine Mfg. & Supply Co.........New York.

CEMENT, IRON FOR REPAIRING LEAKS.
Smooth-On Mfg. Co.........Jersey City, N. J.

CHAINS.
Woodhouse Chain Works......Trenton, N. J.

CHAIN CONVEYORS, HOISTS.
Brown Hoisting Machinery Co. (Inc.)....
.... Cleveland.
General Electric Co........Schenectady, N. Y.

CHAIN HOISTS.
Boston & Lockport Block Co....Boston, Mass.

CHARTS.
Penton Publishing Co.............Cleveland.
Potter, J. D.........................London.

CLOCKS (Marine and Ship's Bell) AND CHRONOMETERS.
Ashton Valve Co.....................Boston.
Ritchie, E. S. & Sons........Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.
Hanna, M. A. & Co...............Cleveland.
Ironville Dock & Coal Co..........Toledo, O.
Pickands, Mather & Co............Cleveland.
Pittsburg Coal Co.................Cleveland.

COAL AND ORE HANDLING MACHINERY.
Brown Hoisting Machinery Co. (Inc.)....
.... Cleveland.

COMPASSES.
Ritchie, E. S. & Sons........Brookline, Mass.

COMPASS CORRECTORS.
How, Benj. V.......................... Boston.

CONDENSERS.
Great Lakes Engineering Works......Detroit.
Thropp & Sons Co., John E...Trenton, N. J.

CONTRACTORS FOR PUBLIC WORKS.
Breymann & Bros., G. H.............Toledo.
Buffalo Dredging Co.................Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Fitz-Simons & Connell Co...........Chicago.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros.......Sault Ste. Marie, Mich.
Hubbell Co., H. W...............Saginaw, Mich.
Lake Superior Contracting & Dredging Co.,
.... Duluth, Minn.
Smith Co., L. P. & J. A...........Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M..........................Detroit.

CORDAGE.
Baker & Co., H. H..................Buffalo.
Upson-Walton Co..................Cleveland.

CORK JACKETS AND RINGS.
Armstrong Cork Co............Pittsburg, Pa.
Kahnweiler's Sons, D..............New York.

CRANES, TRAVELING.
Brown Hoisting Machinery Co......Cleveland.

DIVING APPARATUS.
Morse, A. J. & Son..................Boston.
Schrader's Son, Inc., A....... ... New York.

DRAFT, MECHANICAL.
Sturtevant Co., B. F............Hyde Park, Mass.

DREDGING CONTRACTORS.
Breymann & Bros., G. H.............Toledo.
Buffalo Dredging Co................Buffalo.
Dunbar & Sullivan Dredging Co......Buffalo.
Fitz-Simons & Connell Co...........Chicago.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros..........Sault Ste. Marie, Mich.
Hubbell Co., H. W...............Saginaw, Mich.
Lake Superior Contracting & Dredging Co.
.... Duluth, Minn.
Smith Co., L. P. & J. A...........Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M.........................Detroit.

DREDGING MACHINERY.
Quintard Iron Works Co...........New York.

DRYING APPARATUS.
Sturtevant, B. F. Co.......Hyde Park, Mass.

DRY DOCKS.
American Ship Building Co........Cleveland.
Atlantic Works...........East Boston, Mass.
Buffalo Dry Dock Co.................Buffalo.
Chicago Ship Building Co............Chicago.
Craig Ship Building Co...........Toledo, O.
Cramp, Wm. & Sons............Philadelphia.
Detroit Ship Building Co.............Detroit.
Great Lakes Engineering Works......Detroit.
Lockwood Mfg. Co.......East Boston, Mass.
Milwaukee Dry Dock Co..........Milwaukee.
Newport News Ship Building Co.........
......................Newport News, Va.
Shipowners Dry Dock Co............Chicago.
Superior Ship Building Co.....Superior, Wis.
Tietjen & Lang Dry Dock Co.....Hoboken, N. J.

DREDGE BUILDERS.
Manitowoc Dry Dock Co........Manitowoc, Wis.

DYNAMOS.
General Electric Co..........Schenectady, N. Y.
Mietz, Aug...........................New York.
Sturtevant, B. F. & Co..........Hyde Park, Mass.
Thropp & Sons, John E............Trenton, N. J.

ECONOMIZERS, FUEL.
Sturtevant Co., B. F............Hyde Park, Mass.

ELECTRIC HOISTS AND CRANES.
General Electric Co........Schenectady, N. Y.

WANTED and FOR SALE Department.

PROPOSALS.

U. S. Engineer Office, Buffalo, N. Y. November 27, 1905.—Sealed proposals for excavation in Black Rock Harbor, Buffalo, N. Y. will be received here until 11 A. M. January 15, 1906, and then opened. Information furnished on application. H. M. Adams, Col. Eng'rs.

FOR SALE.

THAT'S OUR BUSINESS

Buying, Selling, Chartering BOATS.

If you desire to charter, sell or buy let us help you.

CHICAGO STEAMER EXCHANGE,
No. 2 Rush Street.
Long Distance 'Phone Cent. 5046. **CHICAGO.**

SIDE WHEEL PASSENGER STEAMER,
particularly desirable for River Service; allowed 800 Passengers. Complete equipment—outfit in excellent condition. Address Box 87 MARINE REVIEW, Cleveland.

FOR SALE.—Barkentine "Savoia", 422 tons gross, steel, built 1891. Good condition. Carries 700 tons. In New York, must be sold promptly by Receiver. F. H. WEEKS, 32 Broadway, New York.

WANTED.

WANTED POSITION.—By an energetic, progressive, young man; twelve years experience. Mechanical marine business preferred, and will travel. Experienced with indicator work. Desire a situation where there is an opportunity for advancement. Address Box 90, THE MARINE REVIEW, Cleveland, Ohio.

WANTED—A1 man to take care of open hearth steel plant and blooming mill. State salary and former experience. Address New York State Steel Company, Buffalo, New York.

WANTED LIGHTER.
Large lighter; one that will carry about 800 or 1000 tons on deck. Must be strong and sound. Give dimensions and lowest cash price. Box 89 MARINE REVIEW, Cleveland.

WANTED.—A small passenger steamer 100 tp, 120 feet long, 25 feet beam, in good condition and speed of not less than 13 or 14 miles. Address, Box 88 MARINE REVIEW, Cleveland, O.

WANTED.

WANTED.—Light draft Hull or steam yacht. Hull about 40 ft. long to draw when fitted and coaled, not more than 4 ft., or would buy steam yacht or tug of 10 tons—to be used for pleasure and some work. If a bargain, could remodel. Must be light draft and good power. Address Lock Box 12, Sta. A, Superior, Wisconsin.

WANTED TO PURCHASE.—Good steel or wooden vessel of Welland canal size. Must be in good condition and have sufficient power to enable her to tow one vessel varrying fifteen hundred tons. Address Box 84, MARINE REVIEW, Cleveland.

Wanted to purchase old hull or vessel of fair condition, that can be repaired at a limited cost for lighter or derrick. Length about 160 ft., beam not less than 28 ft. Address box 86, MARINE REVIEW, Cleveland.

WANTED.—Harbor tug about 14" x 16" engine, adequate boiler, hull about 60 feet. Must be in first class condition every way. For cash. Address, Box 89 MARINE REVIEW, Cleveland, O.

Buyers' Directory of the Marine Trade.—*Continued.*

ELECTRIC LIGHT AND POWER PLANTS.
General Electric Co.......Schenectady, N. Y.
Mietz, Aug........................New York.
Sturtevant, B. F. & Co......Hyde Park, Mass.
Thropp & Sons, John E.......Trenton, N. J.

ENGINE BUILDERS, MARINE.
American Ship Building Co........Cleveland.
Atlantic Works...........East Boston, Mass.
Chicago Ship Building Co..........Chicago.
Chase Machine Co.................Cleveland.
Cramp, Wm. & Sons............Philadelphia.
Craig Ship Building Co...........Toledo, O.
Detroit Ship Building Co..............Detroit.
Fletcher, W. & A. Co.........Hoboken, N. J.
Fore River Shipbuilding Co....Quincy, Mass.
Great Lakes Engineering Works.Detroit, Mich.
Hall Bros. ....Philadelphia.
Lockwood Mfg. Co..........East Boston, Mass.
Maryland Steel Co.......Sparrows Point, Md.
Mietz, Aug.......................New York.
Milwaukee Dry Dock Co..........Milwaukee.
Mosher, Chas. D..................New York.
Moulton Steering Engine Co.......New York.
Newport News Ship Building Co.........
..........................Newport News, Va.
New York Shipbuilding Co......Camden, N. J.
Northwestern Steam Boiler & Mfg. Co...
.............................Duluth, Mich.
Quintard Iron Works Co...........New York.
Roach's Ship Yard...............Chester, Pa.
Sheriffs Mfg. Co..................Milwaukee.
Superior Ship Building Co....Superior, Wis.
Thropp, J. E. & Sons Co......Trenton, N. J.
Trout, H. G..........................Buffalo.

ENGINE BUILDERS, STEAM.
Sturtevant Co., B. F...........Hyde Park, Mass.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.
Cory, Chas. & Son...............New York.
Marine Mfg. Supply Co............New York.

ENGINEERING SPECIALTIES AND SUPPLIES.
Kieley & Mueller ....New York.
Lunkenheimer Co. ....Cincinnati.
Northwestern Steam Boiler & Mfg. Co...
.... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.
Hynd, Alexander ....Cleveland.
Hunt, Robt. W. & Co.................Chicago.
Kidd, Joseph..................Duluth, Minn.
Mosher, Chas. D...................New York.
Nacey, James ....Cleveland.
Roelker, H. B. ....New York.
Wood, W. J. ....Chicago.

FANS FOR VENTILATION, EXHAUST, ETC.
Sturtevant, B. F. Co........Hyde Park, Mass.

FEED WATER PURIFIERS AND HEATERS.
Greacen-Derby Engineering Co.............
.........................Perth Amboy, N. J.
Ross Valve Co..................Troy, N. Y.

FIRE EXTINGUISHERS.
Safety Fire Extinguisher Co.......New York.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.
General Electric Co.......Schenectady, N. Y.

FORGES.
Sturtevant, B. F. Co..................Boston.
Sutton Co., C. E...................Toledo, O.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.
Cleveland City Forge & Iron Co...Cleveland.
Fore River Shipbuilding Co.....Quincy, Mass.
Macbeth Iron Co..................Cleveland.

FLUE WELDING.
Fix's, S. Sons.....................Cleveland.

FUEL ECONOMIZERS.
Sturtevant Co., B. F........Hyde Park, Mass.

FUELING COMPANIES AND COAL DEALERS.
Hanna, M. A. & Co..............Cleveland.
Ironville Dock & Coal Co..........Toledo, O.
Parker Bros. Co., Ltd..............Detroit.
Pickands, Mather & Co............Cleveland.
Pittsburg Coal Co.................Cleveland.
Smith, Stanley B., & Co............Detroit.
Smith Coal & Dock Co., Stanley B. Toledo, O.

FURNACES FOR BOILERS.
Continental Iron Works..........New York.

GAS BUOYS.
Safety Car Heating & Lighting Co..New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co................Cleveland.

GAUGES, STEAM AND VACUUM.
Ashton Valve Co......................Boston.
Lunkenheimer Co. ....Cincinnati.

GAUGES, WATER.
Bonner Co., Wm. T...................Boston.
Lunkenheimer Co. ....Cincinnati, O.

GENERATING SETS.
Sturtevant Co., B. F...........Hyde Park, Mass.
General Electric Co..........Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph..Jersey City, N. J

GREASE EXTRACTORS.
Greacen-Derby Engineering Co.............
.........................Perth Amboy, N. J.

HAMMERS, STEAM.
Chase Machine Co.................Cleveland.

HEATING APPARATUS.
Sturtevant, B. F. Co......Hyde Park, Mass.
Sutton Co., C. E...................Toledo, O.

HOISTS FOR CARGO, ETC.
American Ship Building Co........Cleveland.
Brown Hoisting Machinery Co. (Inc.)....
.................................Cleveland.
Chase Machine Co................Cleveland.
General Electric Co...............New York.
Georgian Bay Engineering Works........
............................Midland, Ont.
Hyde Windlass Co.................Bath, Me.
McMyler Mfg. Co.................Cleveland.
Marine Iron Co......................Bay City.
Mietz, Aug. ....New York.

HOLLOW SHAFTINGS, IRON OR STEEL.
Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HOLLOW STAYBOLT IRON.
Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HYDRAULIC DREDGES.
Great Lakes Engineering Works......Detroit.

HYDRAULIC TOOLS.
Watson-Stillman Co., The.........New York.

ICE MACHINERY.
Great Lakes Engineering Works......Detroit.
Roelker, H. B...................New York.

INDICATORS FOR STEAM ENGINES.
Ashton Valve Co......................Boston.

INJECTORS.
American Injector Co...............Detroit.
Jenkins Bros. ....New York.
Lunkenheimer Co.................Cincinnati.
Penberthy Injector Co.........Detroit, Mich.

INSURANCE, MARINE.
Elphicke, C. W. & Co..............Chicago.
Fleming & Co., E. J..................Chicago.
Gilchrist & Co., C. P..............Cleveland.
Hawgood & Co., W. A..............Cleveland.
Helm & Co., D. T....................Duluth.
Hutchinson & Co...................Cleveland.
McCarthy, T. R.....................Montreal.
McCurdy, Geo. L.....................Chicago.
Mitchell & Co......................Cleveland.
Parker Bros. Co., Ltd...............Detroit.
Peck, Chas. E. & W. F..New York & Chicago.
Prindiville & Co......................Chicago.
Richardson, W. C..................Cleveland.
Sullivan, D. & Co....................Chicago.

IRON CASTINGS.
Sutton Co., C. E.................Toledo, O.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.............Cleveland, O.
Hanna, M. A. & Co................Cleveland.
Pickands, Mather & Co............Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.
Marine Iron Works................Chicago.
Truscott Boat Mfg. Co.....St. Joseph, Mich.

LIFE PRESERVERS, LIFE BOATS, BUOYS.
Armstrong, Cork Co...............Pittsburg.
Drein, Thos. & Son.........Wilmington, Del.
Kahnweiler's Sons, D..............New York.

LIGHTS, SIDE AND SIGNAL.
Russell & Watson ....Buffalo.

LOGS.
Nicholson Ship Log Co............Cleveland.
Walker & Sons, Thomas....Birmingham, Eng.
Also Ship Chandlers.

LUBRICATING GRAPHITE.
Dixon Crucible Co., Joseph..Jersey City, N. J.

LUBRICATORS.
Lunkenheimer Co. ....Cincinnati

LUMBER.
Martin-Barriss Co...................Cleveland.
Rayner, J. ....Chicago.

MACHINISTS.
Chase Machine Co.................Cleveland.
Hickler Bros.........Sault Ste. Marie, Mich.
Lockwood Mfg. Co..........East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc.............Philadelphia.

MARINE RAILWAYS.
Hickler Bros..........Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF.
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....................New York.

MECHANICAL DRAFT FOR BOILERS.
American Ship Building Co........Cleveland.
Detroit Ship Building Co.............Detroit.
Great Lakes Engineering Works......Detroit.
Sturtevant, B. F. Co.......Hyde Park, Mass.

METALLIC PACKING.
Katzenstein, L. & Co............New York.

MOTORS, GENERATORS—ELECTRIC
General Electric Co.......Schenectady, N. Y.
Sturtevant, B. F. Co.......Hyde Park, Mass.

NAUTICAL INSTRUMENTS.
Benjamin Farnum How..................Boston
Ritchie, E. S., & Sons......Brookline, Mass.

NAVAL ARCHITECTS.
Hynd, Alexander ....Cleveland.
Kidd, Joseph ....Duluth, Minn.
Mosher, Chas. D..................New York.
Nacey, James ....Cleveland.
Wood, W. J. ....Chicago.

OAKUM.
Stratford, Oakum Co.......Jersey City, N. J.

OIL ENGINES.
Mietz, Aug. ....New York.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph..Jersey City, N. J.
Standard Oil Co..................Cleveland.

PACKING.
Jenkins Bros.......................New York.
Katzenstein, L. & Co.............New York.

PAINTS.
Baker, Howard H. & Co............Buffalo.
Upson-Walton Co. ....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc............Philadelphia.

Buyers' Directory of the Marine Trade.—*Continued.*

PILE DRIVING AND SUBMARINE WORK.
Buffalo Dredging Co.................Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Fitz-Simons & Connell Co............Chicago.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros.........Sault Ste. Marie, Mich.
Hubbell Co., H. W..............Saginaw, Mich.
Lake Superior Contracting & Dredging Co. .... Duluth, Minn.
Parker Bros. Co., Ltd.....................Detroit.
Smith Co., L. P. & J. A...........Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M.......................... Detroit

PIPE, WROUGHT IRON.
Bourne-Fuller Co...............Cleveland, O.
Macbeth Iron Co......................Cleveland.
Reading Iron Co...............Reading, Pa.

PLANING MILL MACHINERY.
Atlantic Works, Inc............Philadelphia.

PLATES—SHIP, STRUCTURAL, ETC.
Bourne-Fuller Co..............Cleveland, O.
Otis Steel Co......................Cleveland.

PRESSURE REGULATORS.
Kieley & Mueller ....New York.
Ross Valve Co...................Troy, N. Y.

PROPELLER WHEELS.
American Ship Building Co........Cleveland.
Atlantic Works...........East Boston, Mass.
Cramp, Wm. & Sons............Philadelphia.
Detroit Ship Building Co............Detroit.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works......Detroit.
Hyde Windlass Co..................Bath, Me.
Lockwood Mfg. Co. ....East Boston, Mass.
Marine Iron Works.....................Chicago.
Milwaukee Dry Dock Co.........Milwaukee.
Newport News Ship Building Co......... ....Newport News, Va.
Roelker, H. B.........................New York.
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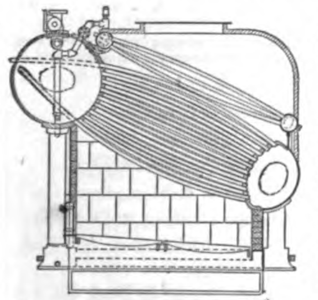

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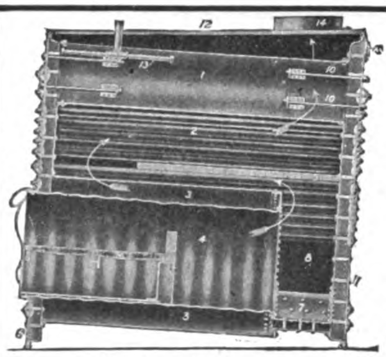

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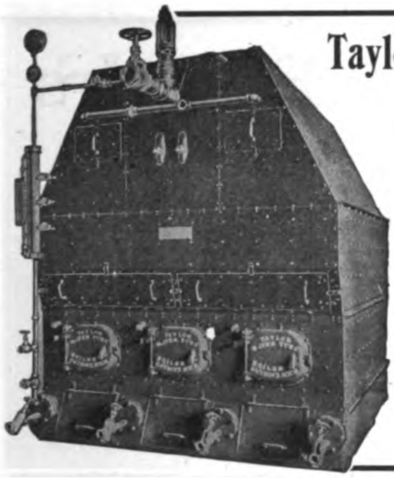

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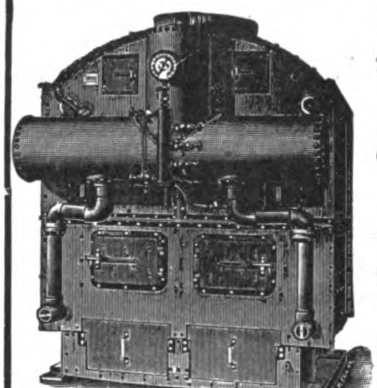

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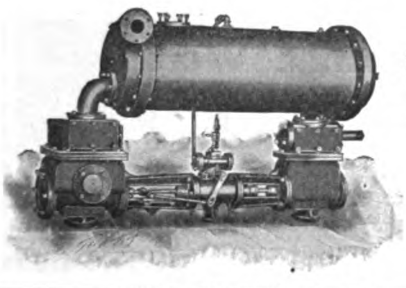

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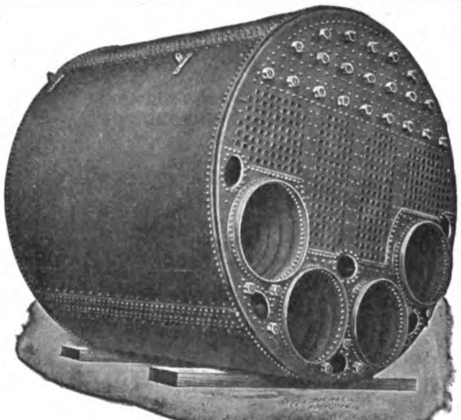

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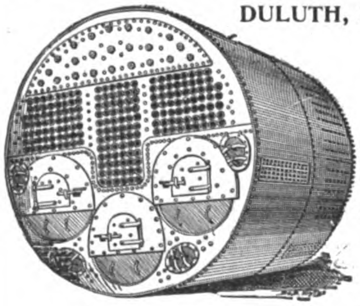

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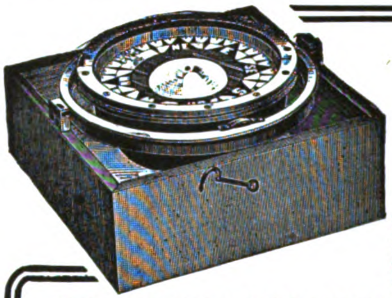

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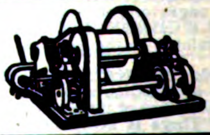

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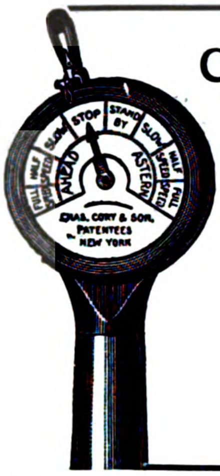

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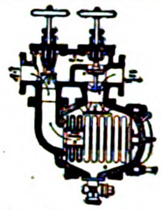

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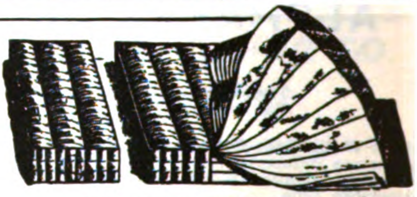

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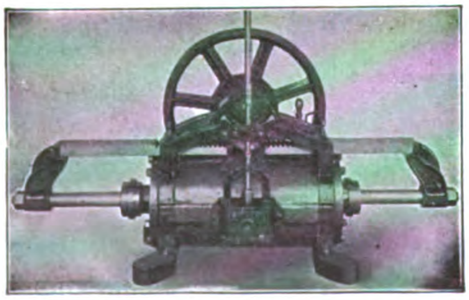

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